# TELEPHONE ENGINEER

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## CARING FOR GROWTH WITHOUT AFFECTING EARNINGS.

One of the most interesting and important problems involved in the commercial and engineering management of telephone properties is that of providing facilities for growing communities. Many exchanges have passed through several cycles in their growth, with corresponding cycles in the amount of net return, that have caused considerable worry to the men who have been responsible for operating results. After the facilities of the original installation have been absorbed, additional facilities were provided for a few years in advance, and as these were absorbed additions again were made only to be filled up so that still more additions were required.

The financial history of these exchanges followed closely the plant history. After a period of small earnings, the exchange became more prosperous, as it had more and more of its facilities brought into service. This period of prosperity then was followed by a lean period, due to increased investment charges on the capital used in providing relief. As the plant again became filled up, prosperity again was reflected in the earnings statement, only to be followed by another period of depressed net income after the next increase in the investment.

Good engineering and commercial management attempts to smooth out these fluctuations and careful planning can do much to prevent abrupt changes. As an example of what may be done, may be cited the case of a certain exchange of about 3,000 stations which apparently had reached the stage of requiring several large cable extensions and additions about three years ago. Commercial surveys indicated a steady growth and a preliminary estimate, based on the present distribution system, showed about $80,000 required to furnish relief.

The plant had been operating at some profit but the margin was small enough that the immediate investment of $80,000 in new plant would result in several years of very small earnings. On this account, it was decided to make rather an intensive study of the distribution systems to determine to what extent some of the work might be deferred without serious inconvenience either to the telephone company or to the public.

It was found that the grouping of subscribers on party lines was done in anything but an economical manner, due partly to haphazard assignment of lines in the past and partly to an insufficient number and improper multiplying of cable terminals. A very considerable relief was secured by working over the lines into better arranged groups and by installing new cable terminals, together with changes of count in existing terminals. In certain sections of the town, substitution of relatively short lengths of larger cable gave relief where the small cables were inadequate.

Today, after three years, the plant has facilities for several years of additional growth in most of the territory and yet less than one fourth of the $80,000 estimated for relief has been expended. The entire $80,000 ultimately will have to be put into the plant but it will be spread over a number of years in such a way that the exchange will not show a single year during which it will not have been operated at a profit.

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## WHY NOT GET TOGETHER? WHO'S TO BLAME?

It is a distinct disappointment to note the continued failure of the two groups in the telephone industry to agree upon the principles involved in the purchase and sale of properties between the groups. This matter has been under discussion for many months, without apparent results. The Independent group, represented by the United States Independent Telephone Association, has been contending that for every purchase by the Bell system, an equal number of stations should be released to Independent ownership. To this proposition the representatives of the Bell system have not agreed, and so the matter stands.

It is true that both groups have expressed the opinion that two strong groups should be maintained in the industry but agreement on the abstract proposition means little when the practical working out of the plan leaves stationary the growth of the Independent group as a whole, because the Bell system is absorbing stations from it at about as great a rate as the Independents' natural increase.

It is difficult to understand how agents of the Bell system, in the person of officials of subsidiary companies, can undertake and practically complete negotiations for the purchase of Independent companies without notice to the Independent Association, as specifically provided in the Hall Memorandum, without being called to order by headquarters. Control of subsidiary companies in the Bell system is not so loosely held that their officials can act in a manner contrary to the policies of the system without being called to account.

It seems to be a reasonable conclusion that, if there are Independent properties that can be operated better by the Bell, there are, likewise, Bell properties that can better be operated by Independents. A frank admission of this fact by the Bell officials and a disposition to give as well as take, would do much to relieve the strained feeling that seems to be growing up again between the two groups.

## BENEFITS OF CLASS A INDEPENDENT MEETINGS.

Class A Independent telephone executives, accountants and engineers met for the third time in Chicago late in April. As in previous meetings, the sessions were largely executive in character and complete reports of the sessions were not given out. It was announced, however, that considerable progress had been made in securing uniformity in accounting practices and that the work of preparing a plant-accounting handbook, authorized at the last national convention, was under way.

Such meetings can not help but have a beneficial effect upon the industry when executives, accountants and engineers meet and discuss their common problems and agree upon procedure that is calculated to bring about improvement in general conditions. It is the universal opinion of the men who have attended these meetings, that real progress has been made as a result of them.

One thing, worthy of comment, is the amount of time and labor that has been spent on the accounting and engineering work by busy men in the various companies. It is not an overestimate to say that each of at least a half-dozen companies actually has donated thousands of dollars to this work, counting the time of executives and department heads as well as traveling and other expenses.

If these companies believe in the work to the extent of making such contributions, certainly every company can contribute its interests, at least, to the extent of being represented at the meeting of its own class when the district meetings are held.

## CONVENTION SCHEDULE

### NEW YORK

Rochester, Powers Hotel, May 19, 20 and 21.

### GEORGIA

Atlanta, Henry Grady Hotel, May 26, 27 and 28.

### WISCONSIN

Madison, Loraine Hotel, June 9, 10 and 11.

### UNITED STATES INDEPENDENT TELEPHONE ASSOCIATION

Chicago, Hotel Sherman, October 12-15.

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## A JOLT TO THE STRIKING SUBSCRIBER

A decision which commends itself to a sense of fairness and justice was made by the Wisconsin Railroad Commission in a recent case of a rural subscriber who applied for service from one telephone company after he had discontinued service on another exchange due to a rate increase. Apparently the subscriber had been instrumental in securing the removal of several telephones in an attempt to force a reduction to former rates and failing in this, applied for service from the second company. The commission found that an increase in rates found lawful by the commission was not a valid reason for transfer of service to another exchange and, therefore, that public convenience and necessity did not require the extension of the lines of the new company into the applicant's territory.

## SPRING FEVER REMEDIES.

Spring fever is a malady that yields to no remedy in the bag of Aesculapius. The only specifics are fresh air, green fields, budding trees and babbling brooks taken in liberal doses. Fortunate indeed is the telephone manager or plant executive who can find the excuse of plant inspections to take him away from office routine when the ailment grips him. Not only does he profit from the medicament of the out-of-doors, but the plant profits because of his more intimate knowledge of the conditions that exist. The treatment can be taken repeatedly as there is small danger of overdose.

## WHY IS IT?

That some people will bite on every get-rich scheme that comes along, no matter how often they've been stung?

That the faces of certain "accident repeaters" are so familiar at the first aid dispensary?

Apparently there is an accident complex as well as a sucker complex and a crime complex.—*Rochester Telephone Bulletin.*

# Types and Care of Central Office Ringing Equipment

By P. KERR HIGGINS

**Central Office Ringing Equipment**

Another type of ringing equipment sometimes found in the smaller exchanges is known as the Illinois pole changer, shown in Fig. 1. This equipment differs from the Warner, chiefly in the arrangement of its mechanical details. The mechanism consists of an actuating magnet, a vibrating arm and contacts mounted on a base plate arranged to be bolted to a wall in such a manner

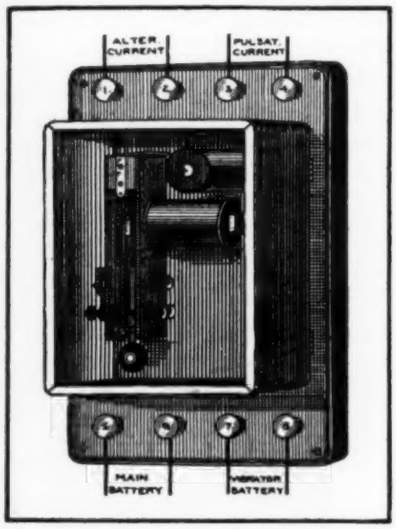


*Fig.* 1

that the suspension of the arm hangs freely, allowing it to vibrate under the impulses of the magnet. The circuit is very similar to that of the Warner pole changer. Another type belonging to the same class, namely, those using dry battery for starting and ringing purposes, is the Western Electric No. 84-B Interrupter. Due to the introduction of power in the smaller exchanges, the use of these types is becoming more and more limited.

**Leich Frequency Converter**

The Leich frequency converter is a device by means of which an electric light circuit can be used for ringing telephone bells. Fig. 2 shows a type known as 7-A frequency converter, which is designed to operate from an electric circuit furnishing alternating current at 110 volts and 60 cycles. The ringing side delivers a 20 cycle, 90 volt alternating current for operating straight line bells.

This type of converter is very economical to operate, as shown in the cost of operation tables, Fig. 3. It will be noted that at an average cost for current and average number of hours of operation per day the average cost is about 75 cents per month. The method of operation of this converter is, first, to rectify the alternating current by means of the two vibrating rectifiers in connection with an impedance coil shunted across the supply current. The rectified current is passed through the 20 cycle (lower) vibrator, after which it is brought up to proper ringing voltage by means of a transformer. All vibrators are operated from the alternating current and thus no additional power apparatus is necessary. The machine is protected from grounds and short circuits by a resistance lamp and all circuits are balanced electrically by the proper use of condensers. It is to be noted that 90 volts

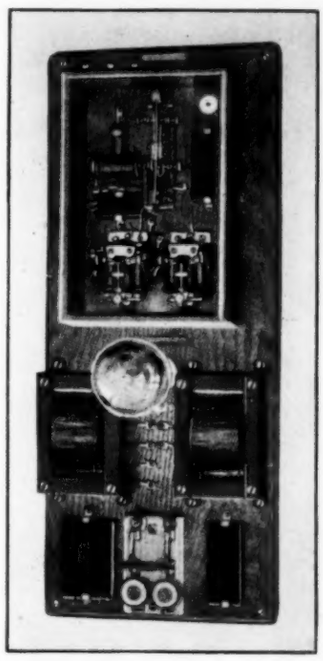

*Fig.* 2

pressure is usually necessary to operate city and rural telephone ringers. If, however, a higher voltage is necessary, it may be obtained by changing the connections at the operating terminals.

In Fig. 4 is shown the details of the circuit of the 7-A Leich frequency converter. The following brief description of the operation of this type of converter is given, it seems, that only a few of those who use this interrupter understand it and as a result criticisms are sometimes unjustly made, when as a matter of fact the difficulty is lack of knowledge on the part of the person in charge of the equipment. When connection is made between the 110 volt, 60 cycle circuit, and the converter by closing the knife switch at the top of the set as shown in Fig. 2, the rectifying vibrators and the main vibrators become energized and start to vibrate by reason of their multiple connection across the leads R and S as shown in Fig. 4. The armatures of the rectifying vibrators (the two top vibrators) vibrate at the rate of 60 cycles per

| Hours Operated Per Day | Current Rates Per K. W. Hour 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|
| 10 | $0.18 | $0.21 | $0.24 | $0.27 | $0.30 | $0.33 |
| 11 | .20 | .23 | .27 | .30 | .33 | .36 |
| 12 | .22 | .25 | .29 | .33 | .36 | .40 |
| 13 | .23 | .27 | .31 | .35 | .39 | .43 |
| 14 | .25 | .30 | .34 | .38 | .42 | .46 |
| 15 | .27 | .32 | .36 | .40 | .45 | .50 |
| 16 | .29 | .34 | .38 | .43 | .48 | .53 |
| 17 | .31 | .36 | .41 | .46 | .51 | .56 |
| 18 | .33 | .38 | .43 | .49 | .54 | .59 |

| Hrs. Oper. Per Day | Current Rates Per K. W. Hour 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|
| 10 | $0.36 | $0.39 | $0.42 | $0.45 | $0.48 | $0.51 | $0.54 |
| 11 | .40 | .43 | .46 | .50 | .53 | .56 | .59 |
| 12 | .43 | .47 | .51 | .54 | .58 | .61 | .65 |
| 13 | .47 | .51 | .55 | .59 | .63 | .67 | .71 |
| 14 | .50 | .55 | .59 | .63 | .67 | .71 | .76 |
| 15 | .54 | .59 | .63 | .68 | .72 | .77 | .81 |
| 16 | .58 | .62 | .67 | .72 | .77 | .82 | .86 |
| 17 | .61 | .66 | .71 | .77 | .82 | .87 | .92 |
| 18 | .65 | .70 | .76 | .81 | .86 | .92 | .97 |

*Fig.* 3

second, while the armature of the lower or main vibrator vibrates at only 20 cycles per second. This vibration of the main vibrator is regulated by an adjustable weight attached to it which may be seen in Fig. 2. Now, assuming an instant when point A is positive and point B negative, the current flows through the two winding of the rectifying vibrators, C and D, and the 0.1 micro-farad condenser from A to B. The polarity of the rectifying magnets is arranged so that

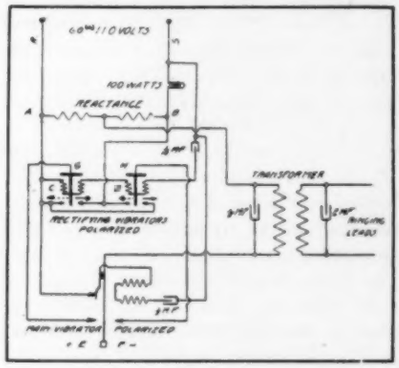


*Fig.* 4

the armatures are attracted in the direction of the dotted arrows. The result of this is that vibrator spring E is connected to the wire R and spring F to wire S. The moment A is negative and B positive, current flows from B to A through the one-tenth micro-farad condenser and the windings of the rectifying vibrator.

This action causes their armatures to be attracted in the direction of the solid arrows which connect the main vibrator springs E and F to wires S and R. It will be noted that spring E will thus be always positive and spring F always negative. The main vibrator armature vibrating as it does at 20 cycles comes in contact with spring E and an impulse of current flows through the primary winding of the transformer from wire R

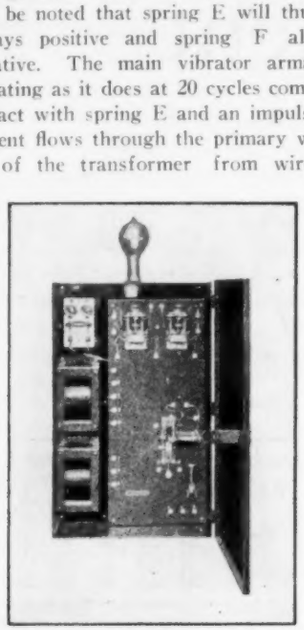

*Fig.* 5

through the spring and armature of the vibrator G, thence through spring E and armature, then through the primary of the transformer to the middle of the reactance coil to wire S. Just after this impulse another impulse will flow through the primary in the opposite direction from wire S through the resistance lamp (100 watts), one-half of the reactance (connected between A and B), through the primary of the transformer and through the armature and spring of the main vibrator, thence through the armature and spring of rectifying vibrator H (top right hand side) to wire R.

The result of this action is that an alternating current having a frequency of twenty cycles is induced in the secondary winding of the transformer to which the ringing wires are connected. The function of the condensers which are connected in series with the vibrators is to keep the current supply through the vibrator coils within defined limits. The condenser connected in multiple with the primary of the transformer is provided to prevent sparking or arcing of the main vibrator contacts. The condenser in multiple with the secondary is inserted to prevent sparking at the ringing keys and also to eliminate inductive noises. The ringing current is entirely insulated from the power circuit by the transformer so that grounds on the power lines will not affect the current output. Two voltages are supplied, high and low, to be used at the discretion of the attendants and determined by the condition of the longest lines.

This type of converter is furnished in two styles: those mounted on an oak backboard known as Nos. 7 and 8, while Nos. 107 and 108 are assembled in black enameled steel cabinets. This latter arrangement is made in order to comply with the requirements of the National Board of Underwriters and is shown in Fig. 5.

Another type of converter furnished by the same manufacturer is intended to operate from direct current circuits or storage batteries at voltages ranging from 10 to 220 volts. Only one vibrator is required to produce 20 cycle current. Ringing current is entirely insulated from the power current and the ringing leads are protected by the resistance lamp in this as in all other machines, except those

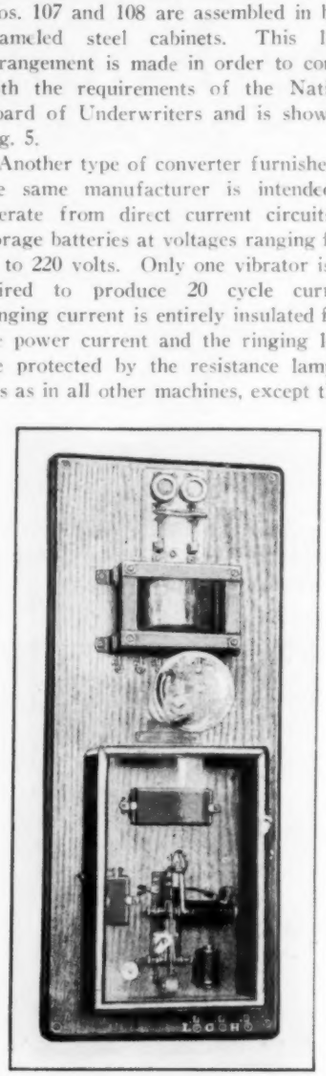

*Fig.* 6

operating at very low voltages. A converter of this type known as the 9-A ringing converter is shown in Fig. 6. It is furnished in either wood or steel cabinets as required.

### Combined Ringing and Charging Machines

This type of machine or vibrator, also made by the Leich Electric Co., is intended to operate from an alternating current lighting circuit. The purpose of the combined ringing and charging machine is to provide a positive source of ringing current that is independent of the voltage of power supply. With this equipment, storage batteries are employed for the purpose of producing ringing current and are charged by means of vibrating rectifiers, incorporated in the equipment. These machines are built in two sizes, that is equipped with single or duplicate charging equipment. They are, however, similar in their operation, which is as follows: The alternating power current is reduced in voltage from a step-down transformer, rectified by the mechanical vibrators, and then passed through resistances to the storage batteries. The vibrators are provided with a relay lock which is used to disconnect the battery circuit whenever power is interrupted and which will unlock when power is applied. Resistance units and lamps are used in the charging circuit, the latter to indicate when the machine is charging. For exchanges having one and two position switchboards, a single rectifier machine is recommended, while exchanges with three or more positions should use the two rectifier machine. This type of machine is furnished in two classes, known as the standard and harmonic. The standard type produces 20 cycle alternating current, or 20 cycle alternating and pulsating current for selective ringing. The harmonic type will be described later. Both of these types are furnished in wood and steel cabinets as desired. This combined machine, known as 15-A, is suitable not only for furnishing current for ringing, but also for operators' transmitters, thus giving much more uniform and efficient transmission, to say nothing of the economy of this arrangement. The operation of the machine is as follows: Current from the power circuit is changed to direct current so as to charge two sets of twelve volt

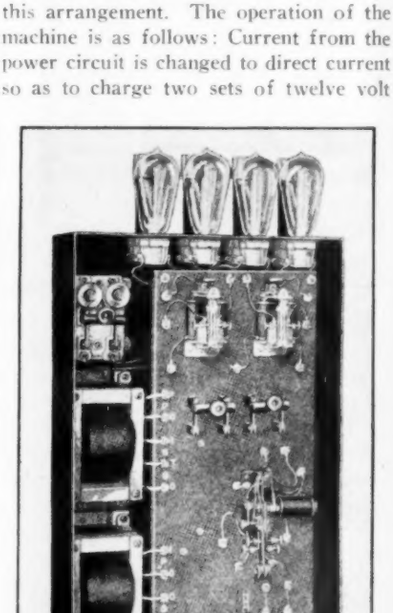

*Fig.* 7

storage batteries. The necessary rate of charge is determined by local conditions and controlled by means of lamp resistance. The charging rate is usually determined by dividing the capacity (in ampere hours) by eight. Ringing current is obtained by transforming the twenty-four volt direct current to alternating current by means of a pole

changer and then stepping it up to the proper voltage through a transformer. After the rate of charge is regulated the operation becomes automatic in itself, opening and closing in answer to the current supply as previously outlined. When current is used for operators' sets it is necessary to use full 24 volt battery in order not to discharge the battery unequally. It is therefore necessary to change or convert the operators' set to common battery, which can be done very easily by wiring in an auxiliary set consisting of an impedance coil, an induction coil, and a condenser, the whole being mounted on a wooden block. This auxiliary set is known as the Leich No. 2-A operator's set, as shown in Fig. 8. The dual use of this machine in a telephone exchange eliminates the separate upkeep of switchboard batteries and with the storage battery in reserve insures a reliable source of ringing current. The average cost of operating this equipment in an exchange from 350 to 500 stations with not over three operator's positions would be approximately $1.50 per month.

**Leich Harmonic Converters**

Selective ringing on rural and party lines has made it profitable to extend and increase this telephone service, not only into sparsely residential districts, but even into the nearby rural districts, as the superior service is usually eagerly sought in preference to the ordinary party line. This is particularly true

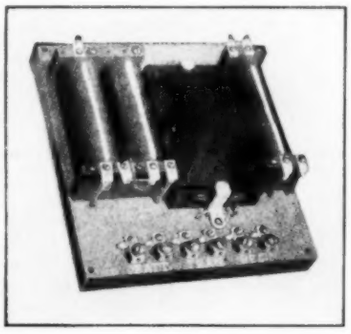

*Fig.* 8

where subscribers because of the limited necessity of the telephone are not willing to pay high rates and where single or direct party line would be prohibitive. The employment of the selective ringing system has also enabled telephone companies to maintain higher rates than would have been possible with code ringing systems. There are three classes of selective ringing. First, biased ringer using positive and negative pulsating current, but having no tuned frequency. Second, harmonic or tuned Reed ringer, using fixed frequency ringing current. Third, pulsating harmonic ringing system, using tuned harmonic ringers actuated by positive or negative fixed frequency current only.

The class of selective ringing which should be used is usually determined by local conditions. Ringing machines producing pulsating current have already been described. The success of harmonic ringing machines depends upon the stability or reliability of the ringing current and also upon the ability of the harmonic ringers to maintain their rated frequency adjustment. It is apparent, therefore, that when a machine is operated directly from a source of power supply, the output will vary directly with the speed of the machine, which in turn varies with the voltage of the supply current. Some power stations do not maintain constant or uniform voltage and the above described harmonic set has been specialy designed to overcome difficulties of this kind. Storage batteries will maintain constant voltage

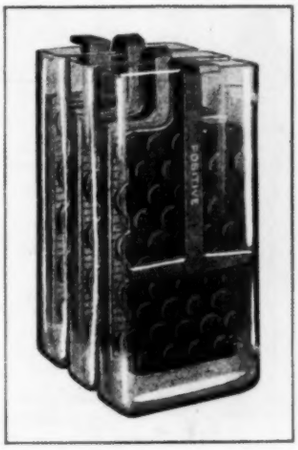


*Fig.* 9

if kept on charge. With the combined harmonic ringing and charging machine this is possible by means of the controlled charging rate and mechanical vibrators. The several frequencies of ringing current are produced by tuned vibrating reed pole changers in conjunction with transformers to produce the correct voltage. These reed vibrators are adjustable. All harmonic ringing and charging machines are provided with duplicate charging vibrators, which may be used singly or together depending upon the number of frequencies being operated. Each vibrator charges 24 volt battery at the maximum rate of 1.3 amperes but the volts may be varied by cutting out or cutting in resistance units. This machine operates in connection with storage batteries that are suitable for low charge and discharge rates. The P. T. type of chloride accumulator is recommended for all installations where an open type of glass jar is permissible. This type consists of a negative and positive plate in each cell, supported by a strap which connects the positive of one cell to the negative plate of the adjacent cell (in series). The jars are supplied with a glass cover which prevents excessive evaporation and spraying when the battery is on charge. Twelve complete cells are supplied with an extra jar and the necessary bolt connectors to wire the batteries to the ringing machine. The glass jars should be set in a tray about three inches deep, filled with sand. This type of cell is shown in Fig. 9. When space is limited or it is more convenient to use the closed top jars the K. R. L. battery is used. These batteries are similar to

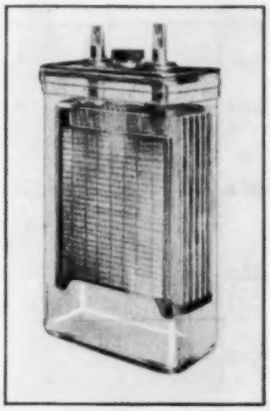

*Fig.* 10

those used for farm lighting and are adopted because of their low charging and discharging rate. This type of cell is shown in Fig. 10.

At this time it might be well to note that special ringers are used in connection with harmonic systems and are furnished with reeds specially designed to respond to certain frequencies. While a large number of frequencies can be provided the following are the most popular sets. (1) 30-42-54-66. (2) 16-33-50-66. (3) 16-30-42-54-66. A ringer of this type is shown in Fig. 11 and a straight ringer is shown in Fig. 12, so that the difference may be noted. In Fig. 13 is shown a biased ringer and in Fig. 14 a pulsating harmonic ringer, so that the difference may be noted.

The combined harmonic ringing and charging machine known as type 28 is shown in Fig. 15. It is very important that these machines be set up properly and it might be well to consider this before describing the operation of the machine. First, it is important to note this converter is designed to discharge a 24 volt storage battery from a 60 cycle 110 volt lighting circuit and furnishes the following frequencies: 16-33-50-66. Second, the converter should be fastened to a solid wall with the porcelain fuse block at the top. Open the switch and cut the cords holding the vibrating reeds of the harmonic vibrators. These are

(Continued on page 28)

# Value of Graphs in the Telephone Field*

By F. J. DOMMERQUE,
*Fellow A. I. E. E.*

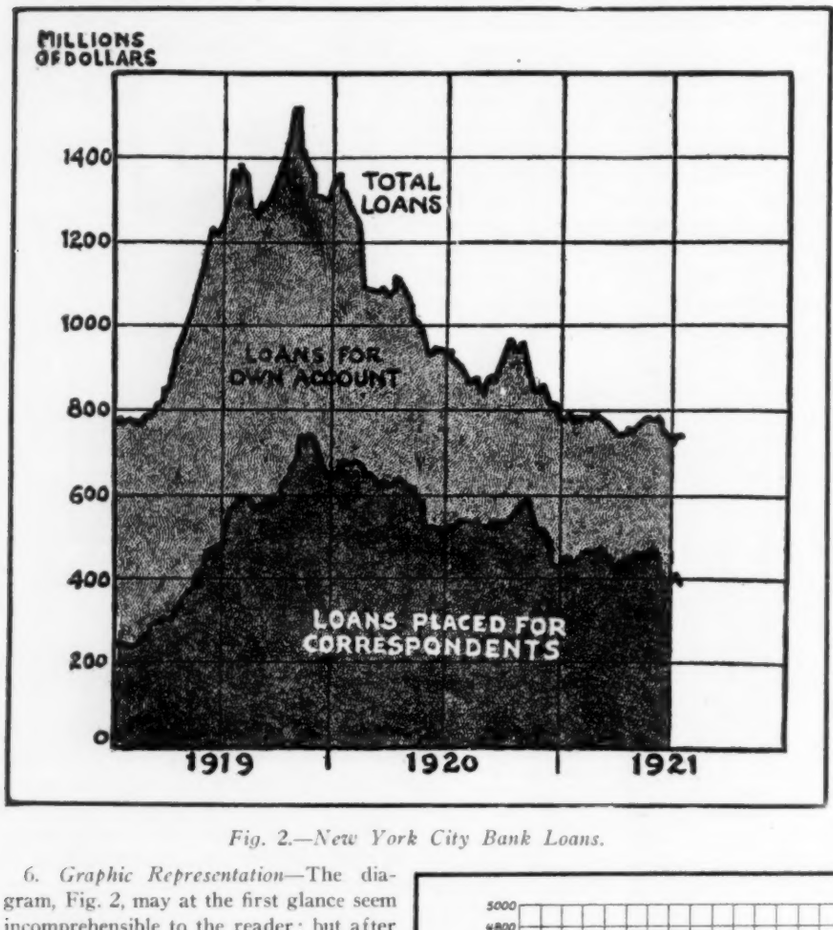


*Fig. 2.—New York City Bank Loans.*

*6. Graphic Representation*—The diagram, Fig. 2, may at the first glance seem incomprehensible to the reader; but after a few words of explanation it will appear exceedingly simple. The diagram was taken from the "New York Sun" and represents a record of the loans made by 52 New York City banks to Wall street during 1919, 1920 and 1921. The curves represent the daily variations during those three years. The horizontal base line on which the three years are annotated can be subdivided into 365 days for each year. In fact, the diagram must have been constructed by noting down for each day in the three years the total amount loaned and recording it in the following manner on a chart ruled in little squares, known as cross section paper. The total amount of loans in the first day of 1919 was in round figures 790 million dollars. As will be seen in Fig. 2 there is along the left-hand vertical edge a scale laid out in millions of dollars. Find in this scale the place for 790 (it is not marked but lies just below the 800 mark); there the record line commences. On the second of January and on the following days and weeks the daily amount of loans varied little until somewhere in April it rose and crossed the 800 million line; after that it rose rapidly. About the middle of June it crossed the 1200 million line. In August it dropped a little, but mounted again until it reached its highest peak in October, 1919, when it stood at about 1550 millions. Then it dropped steadily to the end of 1921 with occasional rises at intervals.

This plotting of a number of observations in a curve is the best means to analyze current events. The loan curve had been constructed by bankers and has nothing about it pertaining to mathematics or physics, it is simply a record. The banker would never have been able, in looking over the thousand or more daily loan figures he had tabulated during the three years, to form as clear an idea of the rate of increase and fall as he could from the curve. There are occasions in every business where such a sheet of curves is of inestimable value to judge the past performance by and to make prophesies for the future with a high degree of confidence and assurance.

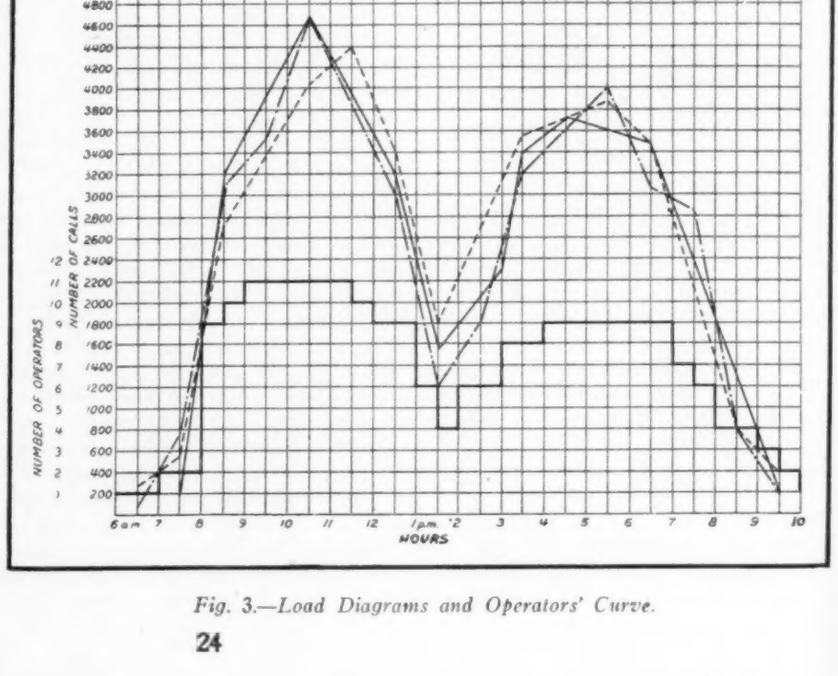


*Fig. 3.—Load Diagrams and Operators' Curve.*

*Second article on "Telephone Mathematics and Physics."

A more pertinent example of this method of recording observations is given in Fig. 3, which represents load diagrams for three days in a telephone exchange, and the curve of operators employed at each hour to handle this load. This diagram has marked on the horizontal scale the time, as was also the case with the loan curve, but in this case the units in the scale are the hours of the day. On the left-hand side, along the vertical line, two scales are indicated; the one for the number of calls in each hour and the other one for the number of operators. The calls and the operators are plotted with reference to the same hour so as to illustrate more strikingly the relation of the number of operators to the number of calls. Such a chart enables the traffic manager to arrange his operating force to the best advantage. In reading these load curves, it must be understood that the total number of calls during one hour is plotted midway between the hour marks, giving a series of points each one representing the total calls in an hour. The points are then connected together to obtain a continuous curve to show better the rate of increase and decrease and also in order to know which of the points belong to one and the same day. For the operator's curve, each change in the curve means that the total number of operators employed at the switchboard during the hour has been increased or decreased as the case may be, to the level indicated by the line for the next following hour. This change sometimes occurs at the half hour.

These two examples, illustrating a series of observations by curves, certainly demonstrate the usefulness of graphical representation. A prominent English engineer and scientist once read a cleverly written article upon the way in which the English population and wealth and taxes were increasing; the reasoning was very difficult to follow. On taking the author's figures, however, and plotting them on squared paper, every result was brought out upon the curves, so plainly that a boy could understand them. This prompted the engineer to remark: "Possibly this is the reason why some writers do not publish curves; if they did, there would be little need for writing."

We now proceed to the concise statement of recording information by curves. Whenever a series of observations is made and plotted on a sheet of cross section paper (ruled in squares) with reference to the two adjacent edges of the sheet, the lines formed by these edges and their continuations are made the two axes of a system of reference called the "*System of Co-ordinates.*" The point of intersection of the two axes as the "origin" of the system is designated by O, and the two axes by X-axis or axis of X, and Y-axis or axis of Y respectively, the axis of X being the horizontal and the axis of Y the vertical axis.

The points along the X-axis correspond to the values of independent variables and are given by their distance from O. Generally, variable values are designated by the letters x, y and z. In the case of co-ordinates, any value on the X-axis is designated by x, which may be any real number. The points along the Y-axis correspond to the values of the dependent variables and are designated generally by y; y being a dependent variable means its value depends on the value of x.

In mathematical writings, the X-axis is often termed the axis of abscissae and the Y-axis the axis of ordinates; then the values of x are the abcissae and the values of y the ordinates.

The system of co-ordinates includes also the values of $-x$ and $-y$; therefore the X-axis must be extended to the left of O and the Y-axis must be extended downward; hence we obtain four quarters or "Quandrants," as they are called, as shown in Fig. 4. The location of any point A in the first quadrant can be fixed by drawing a perpendicular line from A to the X-axis and another perpendicular line to the Y-axis, then the distance of the foot of the vertical perpendicular from O, which is $Oa_1$, is the value of x for the point A, or its abscissa, and the distance of the foot of the horizontal perpendicular from O, which is $Oa_2$, is the value of y for point A, or its ordinate. These two distances or values exactly locate the point A. To be accurate we should say the abscissa of A is $+x$ or $+Oa_1$ and the ordinate of A is $+y$ or $+Oa_2$, because in the first quadrant all values of x and of y are positive, but it is customary to omit the plus sign as self-evident. If A were located in the second quadrant, x would be negative as we measure from O to $-Oa_1$ in negative direction, but y would still be positive. In the third quadrant both x and y would be negative, and in the fourth quadrant y would be negative but x would be positive again.

We are going rather thoroughly into the subject of co-ordinates, because they

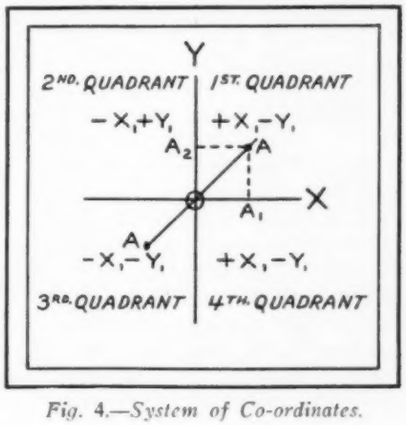


*Fig. 4.—System of Co-ordinates.*

are so important and it is absolutely necessary to have a good grasp of their properties. If the reader does not see clearly all the detail from the beginning, he should not feel discouraged; he will become better acquainted in course of time and finally they will be so familiar to him that he uses them involuntarily. Suppose our A was located in the third quadrant; then it would have the co-ordinates $-Oa_1$ and $-Oa_2$. Draw a straight line from the A in the third quadrant to the origin O and continue the line, and you will find that it passes through the A in the first quadrant. There are a great number of points on this straight line, all of which have different co-ordinates, but for each value of x there is a correspondingly fixed value of y; that is, the values of x are "independent" variables but the values of y are "dependent" variables; the values of x change from point to point and also the corresponding values of y, but the corresponding value of y retain a definite relation to x, y is said to be a "*function* of x," which is briefly written as $y = f(x)$. With other words, $y = f(x)$ stands for any equation which enables us to calculate the value of y from a given value of x.

It should be understood that by "*equation*" is meant a statement of equality between two expressions. There are two kinds of equations: "identical" equations and "conditional" equations. An identical equation may be reduced to the equation $1 = 1$ by adding to, or subtracting from the quantities on both sides of the equation sign equal quantities, or by multiplying or dividing both sides by equal quantities.

Conditional equations can not be reduced to the equation $1 = 1$. The word "conditional" is not often used when speaking of equations, the general term "equation" means as a rule a conditional equation. They are solved by finding a value for x which "satisfies" the equation. Satisfying means reducing it to an identity. Solving an equation is the process of finding values that satisfy an equation. We will not enter at this juncture into a discussion of equations but return to the co-ordinates.

7. *Relation Between Curves and Equations*—Besides the system of co-ordinates under discussion, other systems are used by mathematicians, but they do not interest us here. To distinguish the just described system from the other systems, it is frequently characterized as the system of "rectangular" co-ordinates, because the angle formed by the ordinates and abscissae is a right angle. In mathematical expressions of angles the reader will find the angle mostly measured in degrees. Take any circle with the point O as center, for instance the circle shown in Fig. 5, and divide the circumference of the circle into 360 parts, then each part is

called a degree. The largest circle on earth, the equator, is divided into 360 degrees as we know from our geography lessons. The dial of a watch is divided into 12 equal parts, the 12 hours; each hour is divided again into 5 equal parts, so as to make the dial divisions 60, corresponding to the 60 minutes in an hour. If each one of the 60 parts would be again divided into 6 parts there would be 360 parts in all, each part being a degree of an arc, the entire circumference of the circle containing 360 degrees (written in abbreviation 360°), regardless of the size of the circle, whether it is as large as the equator or as small as the dial circumference of a wrist watch.

The angle formed by the positive X-axis and the positive Y-axis is 90° or a

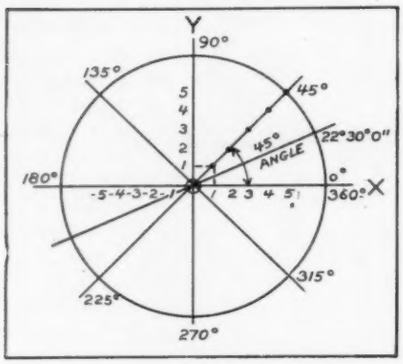


*Fig. 5.*

right angle. The angle formed by the positive X-axis and the negative X-axis is 180° or two right angles. The angle formed by any ordinate with its abscissae is 90°. Dividing the angle between positive X-axis and positive Y-axis into two equal angles, each one will subtend 45°. It is marked that way in Fig. 5. Take a number of points on a straight line drawn through the origin and the 45° angle side in the first quadrant, then select a few points on the X-axis and determine the corresponding points on the Y-axis by going vertically upwards from the points on the X-axis to the 45° angle line and then to the left horizontally to the Y-axis and it will be found that in every case the ordinates and abscissae are equal. The corresponding values can be tabulated as shown below:

| x | y |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |

As all values of x and y are alike, the equation $x = y$ will hold good for any point on the 45° angle line; thus $x = y$ is the equation of a straight line at a 45° angle from the X-axis. From this we can establish the general rule, that if a number of measurements has been made of two quantities depending upon each other and the corresponding values are noted in table form and plotted on a sheet of cross section paper to a convenient scale as the co-ordinates of points, then if these points are connected and it is found that all of them lie on a line passing through the origin of the system of co-ordinates and forming an angle of 45° with the X-axis, the equation $y = x$ will give the law or rule connecting the quantities x and y. This equation may also be written $y - x = o$ or $x - y = o$.

Where accurate measurements are required, as is often the case in physical experiments, the degrees are further divided into 60 minutes each, and each minute again into 60 seconds. The method of designation is then, for instance, 32° 30′ 45″ for 32 degrees, 30 minutes and 45 seconds.

Let us take, as another example, a line passing through the origin O and the 22½° in the first quadrant, which is correctly marked in Fig. 5 as 22° 30′ 0″. Following the same train of reasoning as in the first example, the equation for a straight line passing through the origin and forming an angle of 22° 30′ with the X-axis will be $y = 2x$, or also $y - 2x = o$.

Suppose a series of observed values had given the following table:

| x | y |
|---|---|
| 1 | 4 |
| 2 | 2 |
| 3 | 1.3333.... |
| 4 | 1 |
| 6 | 0.6666.... |
| 8 | 0.5 |
| 12 | 0.3333.... |

Plotting these values, a curve is obtained as shown in Fig. 6. The table shows the following relation between x and y. Whenever the value of x in the left-hand column is divided into 4, the corresponding value in the right-hand column is obtained, for instance $\frac{4}{1} = 4$; $\frac{4}{2} = 2$; $\frac{4}{3} = 1.3333....$; therefore the law which this curve follows is expressed by the equation $y = \frac{4}{x}$. The same law would have been obtained, in the form $xy = 4$, if we had multiplied x by the corresponding value of y in each case.

8. *Applications of Graphic Methods*—The system of co-ordinates is the simplest and therefore the most practical instrument for recording data. Curves are the most illustrative and shortest way to present the results of observations, experiments, calculations, measurements, in short of anything that has to do with practical, industrial, commercial and scientific work. In physical problems, the units in the scale of the X-axis are mostly units of time, be it seconds, minutes, hours, days, months or years; time is a known quantity and is constant. However, there is no restriction to that; any unit is suitable as long as it represents an independent variable. The telephone man can make use of co-ordinates in numerous ways. He can record his expenses for maintenance, his cost of operating and in fact everything pertaining to his business so as to be able to ascertain at a glance how his business stands, whether he is gaining or losing. He hardly will have an occasion to determine equations of curves expressing physical laws from observations, but one never can tell. The writer, shortly after he had entered upon his telephone career, had an opportunity to use to good advantage his mathematical knowledge at the time the Chicago telephone plant was transformed from magneto to common battery operation. New office districts had to be established. One of the first problems was

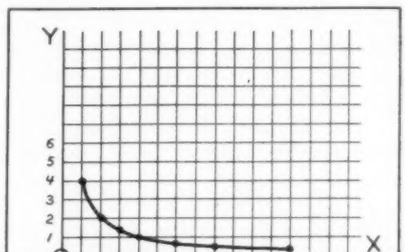


*Fig. 6.*

to determine the proper location of an office. In a single office plant the location, which renders the cost of the wire plant a minimum, is found by locating on a map of the city, or community, the subscribers to be served in the office district, either individually or by blocks (leaving off party line subscribers, or rather counting the party line as one subscriber; the private branch exchange trunks coming under trunk lines; the extension lines being omitted), then moving a ruler across the map in the direction from left to right holding the ruler always parallel to the streets running from a northernly in a southernly direction, and counting the subscribers passed over by the ruler until there are one-half of them on each side of the ruler. Then a line is drawn which will divide the total number of subscribers in the office into two equal halves, as indicated by the position of the ruler. The ruler then is moved across the map in the same manner, from north to south, parallel to the streets running from east to west, until it again divides the subscribers into two equal halves, and another line is drawn across the map, thus obtaining the co-ordinate axes dividing the total number

of subscribers into two equal halves north and south as well as east and west. At the origin of this system of co-ordinates, the office should be located. If, for any reason, this location is not available, the place nearest to it should be selected. It is self-evident that in all such studies cable conduits or pole lines must be measured along streets or alleys.

As Chicago had quite a number of offices to be taken into consideration, the next problem was to find the proper number of offices. How this is done will not be described here, but it may be mentioned the part of the development study which furnishes an example of the application of the curve and equation method described previously; namely, the determination of the average lengths of subscriber's and trunk lines with varying number of offices in the plant.

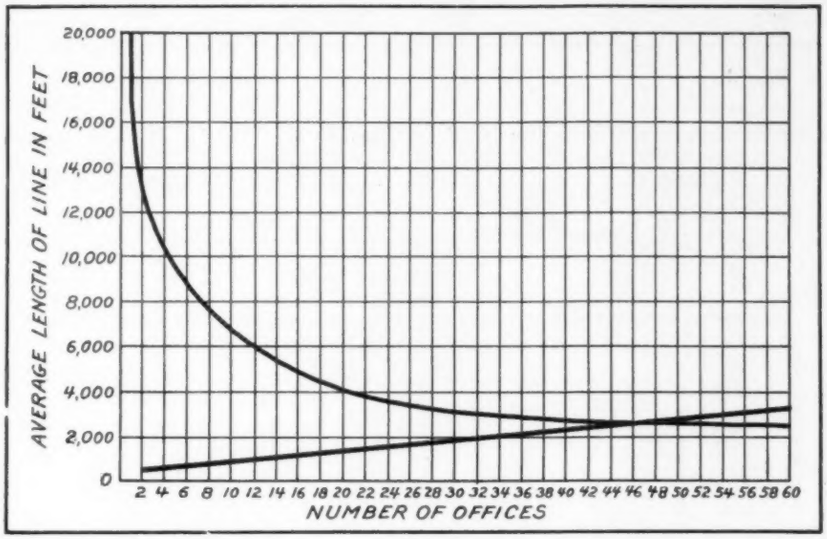


*Fig. 7.*

Assuming, first, the entire plant to have one office only, which would be located by drawing the two axes dividing the number of subscribers into two equal parts each way, at right angles to each other, obtaining at their intersection the theoretical center of the system. Measuring the lengths of lines to this point and dividing the total mileage by the number of lines will give the average length of line with one office. Dividing, next, the system into two office districts, determining the location of the two offices and measuring the lengths of lines again, the average length of lines with two offices is ascertained. This process can be carried on for any number of offices.

A curve then can be plotted with the average length of lines as ordinates and the number of offices as abscissae. This curve would have its highest point for one office and would reach the zero point where the number of offices equals the number of lines, with other words, where each subscriber constituted his own office. In the Chicago case, we figured at that time on a 50,000 line plant. In Fig. 7 such a curve is represented, which was found useful for the Chicago problem. The curve reproduced in Fig. 7 is not the result of actual measurements but of calculation. In the Chicago development study the curve was plotted from actual measurements, the average length of lines with one office and 50,000 lines having been found to be 20,000 feet. The curve of measured values showed that it was practically coincident with a curve having the equation $L^1 = \frac{L}{\sqrt{N}}$, wherein L designated the average length of line with one office and $L^1$ the average length of line with N offices (N may represent any number of offices). The meaning of the symbol $\sqrt{\ }$ will be explained in a future paper.

In the same figure a second curve is plotted, which represents the trunkline mileage with varying number of offices. This curve is obtained by following the same train of reasoning as for the subscriber's line curve. It shows a straight part at the beginning, which is natural; toward the end where the number of offices comes to be equal to the number of lines, it would ascend as rapidly as the subscriber's line curve descends at the start, but this part of the curve is not of interest, hence there is no need of searching for an equation of the second degree as was required for the subscriber's line curve; an equation of the first degree, that is, an equation of a straight line will give a sufficient approximation. Such an equation would be $T^1 = T\left(\frac{1}{2} + \frac{N}{12}\right)$ wherein T designates the average length of trunk line per subscriber with two offices and $T^1$ the average length of trunk line per subscriber with N offices. The explanation of the degrees of equation will also be given at some future time.

Of course, both curves must be taken for what they are worth. They are not intended for an actual measure of lengths of lines, all the more as they are deduced from a single development study; they indicate, however, to a certain degree the relation of subscriber's line and trunk line lengths for varying number of offices.

Finally, in Fig. 8, a curve will be given as an example of a record curve. This curve shows the general expenses per station per year for varying number of stations. The general expenses consist of:

1. Salaries; that is, the salaries paid to officials and clerks.
2. The traveling expenses, stationery, postage, etc., used by them.
3. Insurance against fire and accident.
4. Legal expenses.
5. Damages to be paid in adjustments of claims for accidents.
6. Miscellaneous items of a general nature.

This curve was drawn from data collected by the writer years ago and of course would not hold good any more today, but it serves as an illustration.

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Fort Stockton, Tex.—Leonard Reeves has been named secretary and general manager of the Pecos and Rio Grande Telephone Co., vice E. W. Gorom, resigned.

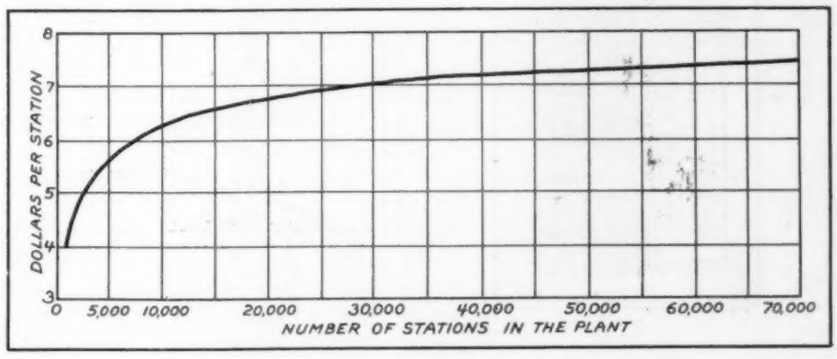



*Fig. 8.—Curve Showing General Expenses Per Station Per Year.*

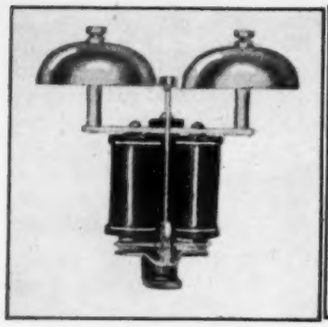


*Fig.* 11

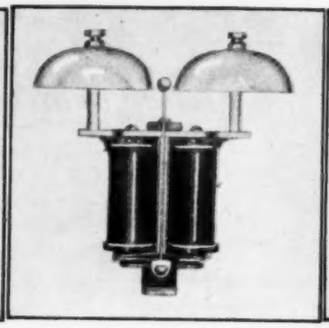


*Fig.* 12

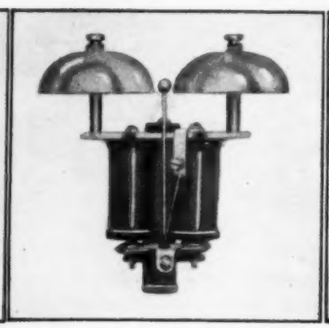


*Fig.* 13

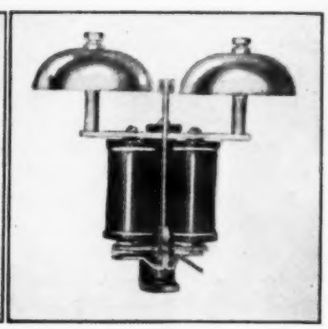


*Fig.* 14

(Continued from page 23)

tied to prevent damage to vibrator in shipment. Third, before proceeding to connect up the converter the blue prints furnished with the equipment should be carefully examined. A skeleton of this is shown in Fig. 16.

### Connecting the Converter

First, connect the 110 volt 60 cycle lighting circuit to the porcelain base switch at the top of the backboard shown in Fig. 17. Second, connect five wires to the ringing terminal marked 66-50-33-16-C at the lower right hand corner of the backboard and run these wires to the power generator party line terminals of the switchboard.

### Batteries

Great care must be taken that batteries are connected up with the proper polarity for if they are reversed when connected, the converter will be damaged. Be very certain that the positive (+) or red terminal of batteries is connected to the positive (+) terminal of the converter. This is usually marked on the side of the case or on the terminal itself. A double pole single closed switch marked No. 1 in Fig. 16 should be connected between the batteries and the converter. If it is desired to have the operator stop the harmonic vibrators at night in order to save current, cut the

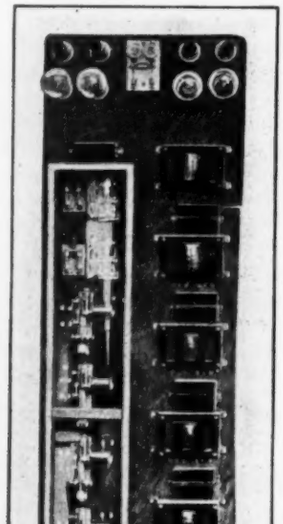


*Fig.* 15

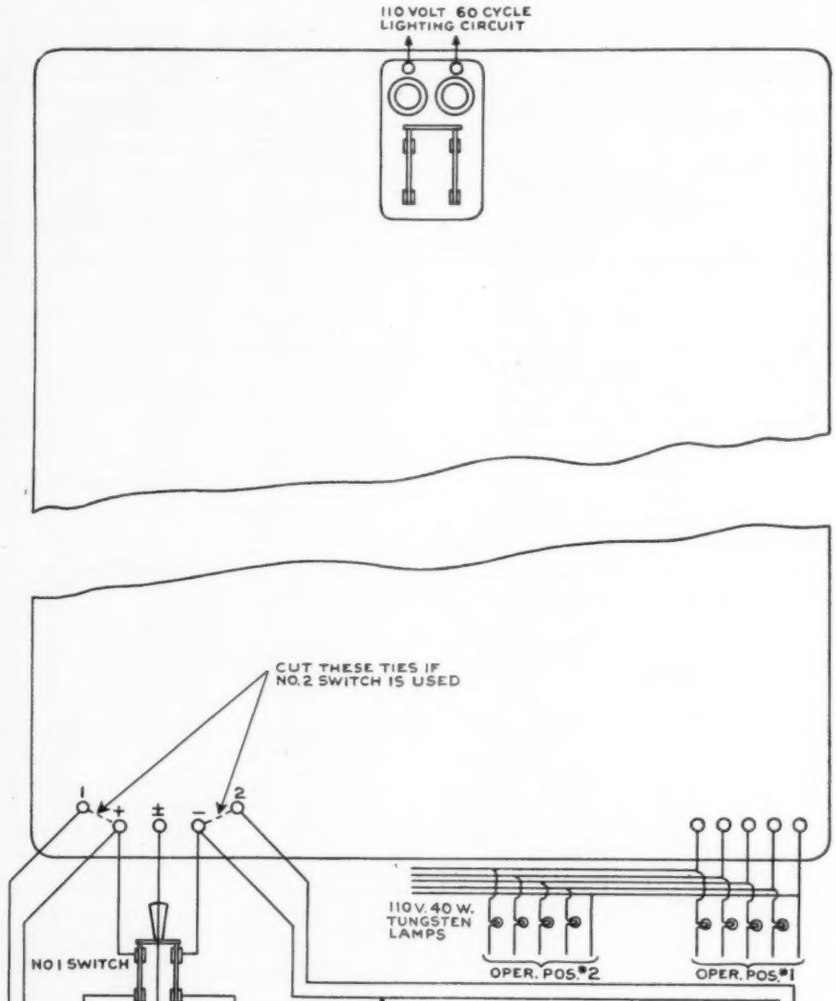



*Fig.* 16

ties between positive (+) and 1. Also, negative (—) and 2. Now run wires from positive (+) and 1 to one blade of a double pole single throw switch (marked No. 2, Fig. 16) and from negative (—) and 2 to the other blade of this switch. Connect the batteries in series, that is, connect the positive terminal of one set to the negative terminal of the other set and from this tie or strap, run a wire to the binding post marked (±) on the converter. A

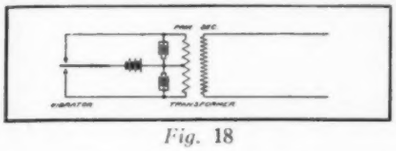


*Fig.* 18

wire should now be run from the positive terminal of one set of cells through the switch to the terminal marked positive on the converter. A third wire should be run from the negative terminal of the second set of cells through the switch to the terminal marked negative on the converter. The total voltage of the batteries should be kept as near 26 volts as possible. The frequency and ringing voltage of each vibrator is adjusted to operate the battery at 26 volts.

### To Operate Converter

First, close the battery switch which will start the four vibrators in motion and furnish ringing current at the frequency indicated on the converter. In this case 66-50-33-16. Second, close the power switch at the top which will start the 60 cycle rectifier in motion and charge the batteries. The charging current will light the lamps. Do not try to operate the harmonic vibrators from the power current only. They must be operated from the batteries. Therefore, open the power switch before opening the No. 1 battery switch. The No. 2 battery switch cuts the harmonic vibrators off from the battery, but permits the battery to be charged.

### Fuses

The fuse plugs have two ampere fuses which may be replaced with two ampere fuse wires when burned out. These

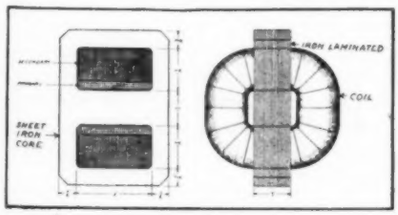



*Fig.* 19

fuses are necessary to protect the battery charging equipment. The open fuses at the left hand side opposite each vibrator are also two ampere fuses and protect the ringing equipment of their respective frequencies. Be careful not to use fuse wire larger than three amperes.

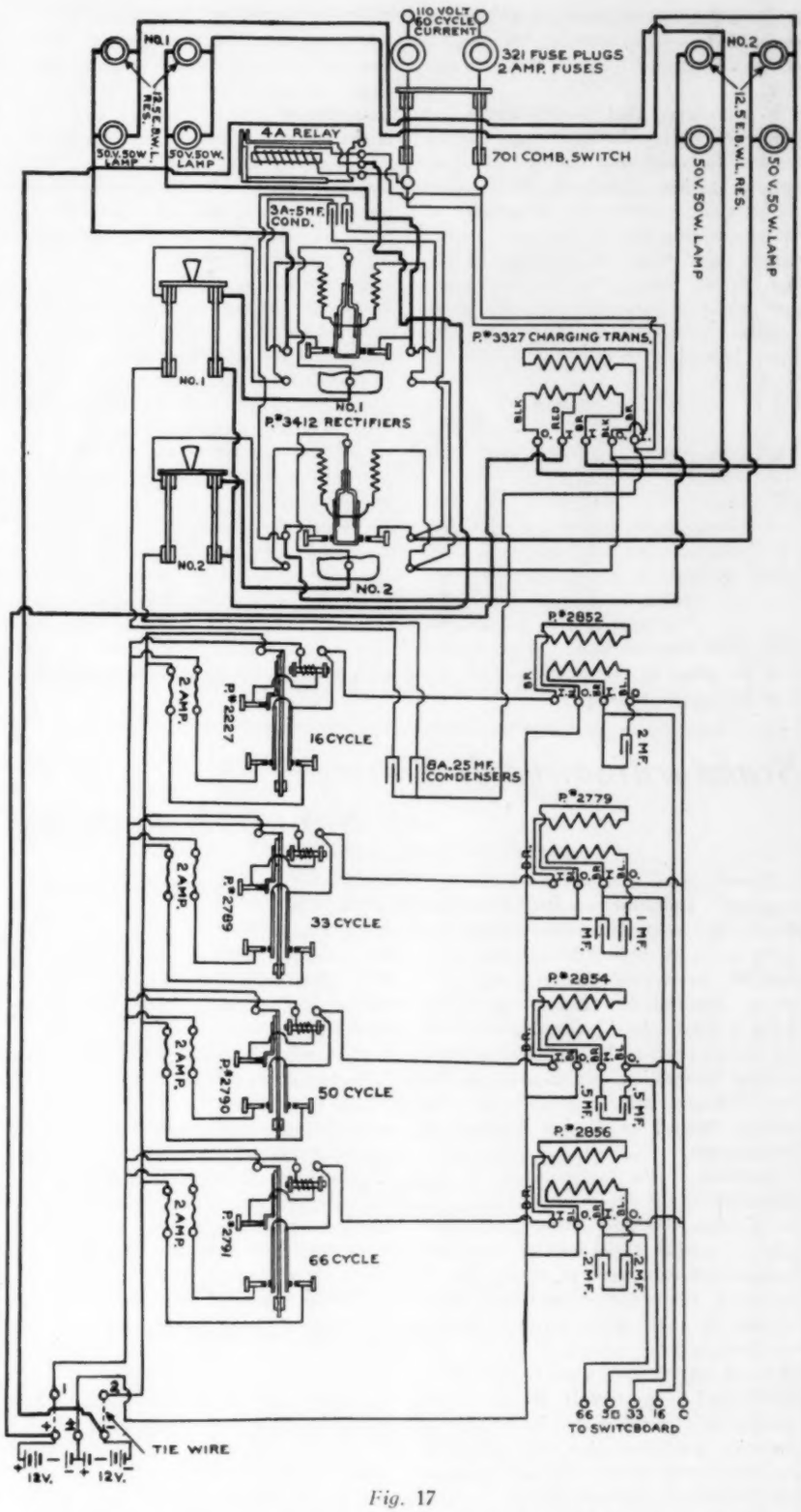



*Fig.* 17

The converter is composed of two distinct parts, namely, the charging and ringing equipment. The batteries are charged by means of the charging transformer and rectifier. The transformer reduces the 110 volt current to the proper voltage. This reduced voltage current passes through the two lamps and the two resistances to the rectifier which changes the alternating current to direct current. The direct current in turn is used to charge the batteries. The current through the batteries may be regulated by means of the lamps and resistances.

The charging current is 1.3 amp. 2

res. and 2 lamps in circuit; 1.15 amp., 3 res. and 1 lamp in circuit; 1.0 amp., 2 res. in circuit, and 0.5 amp., 1 res. in circuit.

It is necessary that the resistances and lamps be inserted and used in the circuits marked for each; one lamp and one resistance to the right and the same to the left of converter. The number of hours charging may be determined after a few days' trial. The charged condition of the battery can be determined and should be carefully tested by taking frequent hydrometer readings. This is very important. The battery should read:

| | Automobile Type | P. T. Type |
|---|---|---|
| Fully charged | 1280 to 1300 | 1210 |
| Half charged | 1220 | |
| Discharged | 1175 | 1180 |

A syringe hydrometer is suitable for this purpose. Do not rely upon voltmeter readings as only hydrometer readings are dependable. Replace the solution lost from cells due to evaporation with pure distilled water. Acid should only be added to the solution under the direction of an expert.

**Rectifying Vibrator**

It is important that the rectifier armature operate with a steady tone or hum. Apply a drop of fine oil to the bearings from time to time. If changes are made in the adjustment be sure to keep the air gap between each pole piece and the armature equal. The armature must not come in contact with the pole pieces. Keep the contact points clean by means of emery cloth or paper. Remove, clean and return one screw to its original adjustment before removing the other. In this way the factory adjustment is maintained. With one contact spring resting against one contact screw there should be an air gap of approximately 1/64 to 1/32 inch between the other spring and contact screw. If the contact screws are too close to the spring, the vibration will be unsteady and if too far away the armature will not start. Keep the screws in as close as possible and still get a steady hum or vibration from the armature. The locking pin centers the vibrating spring and the contact screws should be adjusted so that the contacts are open when the rectifier is not operating.

# *Standardization Is Theme at Kansas Convention*

Topeka, Kan.—Standardization of accounting, operating, construction and maintenance methods received further impetus at the twenty-sixth annual convention of the Kansas Independent Telephone Association. Kansas has been doing a great job of promoting uniformity of first-class methods among its Independent companies, and to continue the work the association re-elected all of its officers, headed by T. L. Youmans of Osawatomie.

Evidence of the Jayhawkers' activities abounded in the report of Secretary L. M. Kraege. He told of the association's work in getting 90 per cent of the state's Independent exchanges to standardize on collection rules and of a nearly equal success in establishing uniform charges for installations, moves, directory listings and reinstatements where subscribers have failed to pay rentals. Results of the association's rate study in improving financing conditions also were related in the secretary's report. Kraege submitted the following recommendations for the members' consideration:

1. That territorial boundary lines be established between telephone exchanges and then a proper effort made to respect these boundaries.

2. That a study be made of conditions in each section, looking toward the merging or consolidation of several smaller exchanges, thus changing the economic condition from a losing one to a profitable condition.

3. That each telephone company study the financial conditions at its plants and if needed, make arrangements for adequate rates to successfully operate the exchange.

4. Companies, which never have had a valuation of their plant made, are urged to do so in order to find out definitely what their investment is. In all checking of so-called "book values" that has been done, the association has never found that such book values properly reflected the investment unless a real valuation had at some time been made and then used as a basis upon which to build.

The telephone's semi-centennial provided the background for some interesting addresses. Harry Faris spoke on "Lessons of the Past" and W. R. Kercher talked on "The Challenge of 50 Years." Public relations came in for treatment at the hands of Elliot Belden, superintendent of public relations for the United of Abilene. Miss Barnes, of the national association, spoke on "Service."

Relations with the employes received attention from F. B. MacKinnon, president of the U. S. I. T. A., whose subject was "Principals and Agents"; Judge John J. Crawford of the Kansas Public Service Commission, who spoke on "Workman's Compensation Law," and from W. H. Highleyman, who told of "The Employers' Problem Under the Compensation Law."

**Amity in Industry Vital**

President MacKinnon during his address said:

"The principals of the Bell group have made certain commitments as to the purchase of Independent properties and as to the procedure they will follow in notifying the Independent principals in connection with negotiations for, and the purchase of, Independent properties. The agents of these Bell principals are obligated to follow out this commitment. Should they not do so—should they act contrary to them—they will be placing their principals in the light of having violated their commitments.

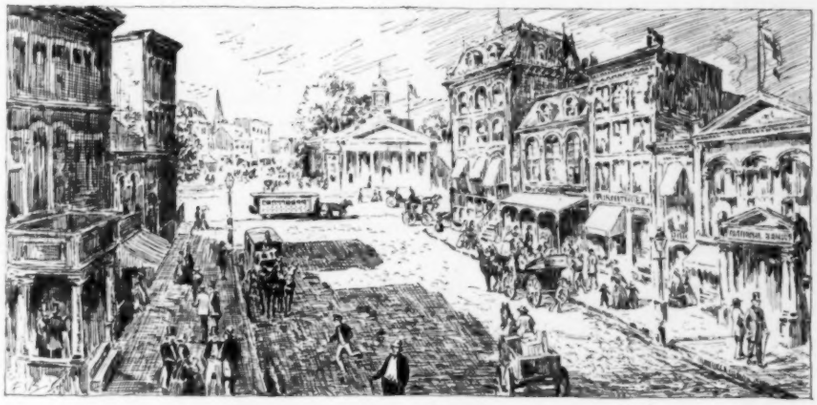
"The Independent group, by the United States Independent Telephone Association, is committed to the policy of being opposed to further acquisitions of Independent properties by any company of the Bell group unless, in exchange for the purchase, the Bell company shall relinquish an equivalent.

"The Bell companies, as represented by their principals, have not agreed to this proposition which in the minds of the Independent principals is the only way that the Independent group can be maintained as a strong organization. The Bell companies are, however, committed to giving 30 days' notice before any negotiations are entered into for the purchase of Independent properties, and to this policy not only the principals but all the companies of the Bell group are committed.

"As has been said at this convention, one reason for the friendly attitude of the public toward the telephone industry is because of the amicable relations which exist between the two groups. It was also well said that, should these amicable relations be disturbed, we may expect a change in the attitude of the public toward the telephone companies.

"This is a point to be borne in mind by the agents of the two groups. Great care should be exercised that nothing should disturb the present situation. Acts of Bell agents here and there throughout the country have tended at times, and in some sections are tending now, to the disturbance of these friendly relations. You will note that I say the acts of the agents, not the acts of the principals.

"It has been agreed between the two groups that there should be two groups and that both groups should be strong and active. It is a weak group, indeed, that, will stand by passively and see part of its organization taken from it. If the Independent group is a strong group, and I think it is, it is not going to remain quiet in the face of constant losses, even though these losses be at scattered points and of no great consequence at any one point."



# *The Telephone and Better Living*

PICTURES of pre-telephonic times seem quaint today. In the streets were horses and mud-splashed buggies, but no automobiles and no smooth pavements.

Fifty years ago homes were heated by stoves and lighted by gas or kerosene lamps. There was no domestic steam heating or electric lighting, nor were there electric motors in the home. Not only were there no telephones, but there were no phonographs, no radio and no motion pictures.

The telephone permitted the separation of business office from factory and made possible the effective co-ordination of widespread activities by a centralized organization. It changed the business habits of the Nation.

The amazing growth of the country in the past fifty years could not have come had not science and invention supplied the farmer, manufacturer, business man and family with many new inventions, great and small, for saving time and labor. During this period of marvelous industrial progress, the telephone had its part. It has established its own usefulness and greatly accelerated the development of the industrial arts which have contributed so much to better living conditions and to the advancement of civilization.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

*BELL SYSTEM*

IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

# Good Cord Circuits Are a Vital Factor

J. M. WALSHE

The cord circuit, described in the April issue of TELEPHONE ENGINEER, is not any particular kind. It might be called a conventional cord circuit since it contains the essentials of a simple system.

When a blue print of a cord circuit, as supplied by a manufacturer, is compared with this conventional circuit, it will be found that many more details are given and one of the first that will be noticed is that the wires are all labeled with a color and some of them also have particulars of the size of wire and its insulation.

It is ordinary practice to use wire made up in pairs, one wire being of a distinctive color, and the other plain. The color of the wires connecting the cord fasteners and the answering cords is the same for all cords and, likewise, all wires connecting the cord fasteners and the calling cords are of one color. Let us put that another way: There is a pair of wires from the key to the cord fasteners of the answering cord. This pair of wires is the same color for each pair of cords.

Again, there is a pair of wires from the key to the ring-off drop, and the same color is used for each such connection. At the same time, each color only is used for one purpose. So, each key has wires of different colors but which are the same for each key. The beauty of this is, that each key has the same colored wire in the same relative position. This is a great help, both in construction and maintenance, as at any time it is only necessary to make the connections the same as the next key. Suppose, on lifting the key shelf to look for an open cord, you see a red and white wire broken off; all that is required is to solder it on where the red and white appears on other keys. Of course, if you know beforehand that the red and white is the cord tip and notice it goes on the main spring of the ringing key, so much the better.

The wire used is No. 22 copper, tinned and double cotton covered, and boiled out in beeswax. Boiling out in beeswax renders it partly waterproof, and also prevents the covering from running back, especially while being soldered. When all is complete, many people give one or two coats of shellac varnish. This gives it a finished appearance and aids in keeping dust from collecting on it.

The complete wiring of a cord shelf is made in a form which consists of a table or large board on a table with finishing nails in rows at such distances as are necessary. The wires are run out from reels overhead and the whole laced together with double mattress twine.

Power wires sometimes are included in this form. Power wires are those used for the ringing and battery circuits. Usually they are No. 20 tinned copper, rubber covered and braided.

The springs used in listening and ringing keys are made of brass or German silver; some makers using both together. In may cases, the important contacts used for speech are provided with special metal—platinum or gold. One spring carries a disc about three-sixteenths of an inch in diameter riveted to it, while the other spring carries a point about one-thirty-second of an inch long and about the same thickness which is riveted to it. These special contacts must be opposite each other so that they meet properly. As before stated, they are of gold or platinum and are furnished so as to provide good contact between the springs. If German silver or brass were used for these contacts they would have to be cleaned and renewed much more frequently, because whenever the circuit was broken and a spark was made at the contact, the contact would be heated quite hot at the point and the base metal would combine with the oxygen in the air, forming a dirty point.

Gold and platinum do not readily combine with oxygen and so keep clean. However, a film of dirt in time accumulates on them; this is common dust, and it may be packed down into a hard lump and eventually cause trouble. To remove this dust, it is not at all necessary to use an abrasive and emery cloth; sand paper never should be used, much less a file, because gold and platinum are very soft metals and easily scratched away. A piece of soft wood, with a piece of clean rag stretched over it, will remove the most obstinate kinds of dirt and yet leave the contacts polished and in good order. Use a clean rag and notice how much dirt comes off. Canton flannel is a good kind of cloth, if the rough side is used.

The contacts of the ringing keys which bring the ringing generator into circuit often are supplied with saw tooth contacts and then are arranged to move on each other. One spring then always rubs a clean place on the other.

The springs of many varieties of keys are insulated and clamped together with hard rubber of the required shape. Hard rubber is one of the most useful insulators, but it alters slightly with age and climate; so that it shrinks in some cases and a spring assembly may not operate as it formerly did. The first intimation probably will be an open, and the springs will not be in contact as they should be. It looks as if the spring should be bent to close the circuit and so clear the trouble. But, before you do any spring-bending, just try what happens when you tighten the screws which clamp the spring assembly.

In the case of many types of keys, that is all that is necessary. Springs should be bent only as a last resort.

When it is necessary to bend springs, use a spring bender which is a tight fit on the spring, and bend at the nearest possible point to the clamping screws.

The connections of a cord circuit on the keys require very careful soldering. Solder appears to crystallize in time and the crystals coming loose soon give trouble. When the solder begins to crack around a wire, it is best to remove the wire, shake off all old solder from the wire, and lug and use new solder to resolder it. The only kind of solder allowed is resin cored solder. No other kind should be used on switchboards, and no salts or paste. If you must have a soldering solution, dissolve resin in wood alcohol.

In making a connection on a key, the wire should be skinned and put through the hole in the lug, then bent back in the direction from which the wire is run; the covering of the wire should end at the top of the lug, and the surplus wire should be cut off at the top of the lug; the connector then to be soldered.

## T-2002
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**T-2002 Peerless Telephone Test Set** provides telephone companies with an instrument which can not be equalled elsewhere for accuracy, simplicity, convenience and durability. It is not to be compared with some of the cheap make-shift sets you may have known any more than a cotton hand-me-down can be compared with a good tailor's finest suit.

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If you have a new idea or patent that you wish to put on the market, get a manufacturing proposition from us. We have a large and modern establishment manned by experienced specialists.

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### Roy-Jax Trimmer Wins High Favor at Iowa

Des Moines, Ia.—That a prophet is without honor in his own country was proven to be the "bunk" at the Iowa Independent convention by the Roy-Jax tree trimmer. The Roy-Jax is made at Audubon, Iowa, and since its introduction to the telephone market, a few weeks before the 1925 Independent convention, the device has been bought by a large majority of the Hawkeye telephone companies, as well as by hundreds of wire companies in other states.

This year at the Iowa meeting the Roy-Jax was shown with a new feature, a clamp for the extension pole. This clamp is an easily-worked, simple and secure device, that is self-compensating for wear. Though many telephone men have tried to do tree trimming with a saw attached to a pole, the only device of this character that has proved to be a practical success is the Roy-Jax tree-trimmer, so its inventors state. The Roy-Jax employs a special saw that operates easily despite the pressure of the partially ruptured branch. The Sitka spruce handle is light and strong—the average weight of the entire device being only six pounds. The tension on the saw is kept just right by the wooden bow feature, so that there's not much work for a man to saw a five-inch limb 18 feet above the ground.


# Material Methods Men

—The right combination of these three factors accounts for the superiority of

## RUNZEL-LENZ CORDS

Our specialization in telephone cord making for almost three decades has taught us the right materials to employ as the basis of dependable cord service. This long experience has shown us the way to the most successful methods of making cords. And it has developed for us a corps of expert, loyal masters of the cordmaking craft who put a high degree of personal pride in their work.

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**RUNZEL-LENZ ELECTRIC MFG. CO.**

*Headquarters for Switchboard and Telephone Cords*

**1751-57 N. Western Avenue** **CHICAGO**


### Announce Biggest White Roll Call with 35,755 Trucks

Cleveland, Ohio—The extensive use of motor truck transportation and its important relation to our industrial and commercial growth is shown by the annual White Roll Call just announced by The White Company. Listing nearly a thousand concerns who operate White trucks and busses in fleets of 10 or more, and representing virtually every line of business, the 1926 roll call is the biggest in the company's history.

The new White Roll Call gives a graphic picture of the tremendous growth of motor truck fleet operation.


**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,**

of Telephone Engineer, published monthly at Chicago, Ill., for April 1, 1926.

State of Illinois, County of Cook, ss.—Before me, a notary public in and for the state and county aforesaid, personally appeared W. H. Graffis, who, having been duly sworn according to law, deposes and says that he is the business manager of Telephone Engineer and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, general manager and business manager are:

Publisher — Wm. H. Graffis & Sons, Chicago, Ill.

Editor—Herbert Graffis, Chicago, Ill.

Business Manager—W. H. Graffis, Chicago, Ill.

Advertising Manager — Jos. M. Graffis, Chicago, Ill.

2. That the owners are (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock):

W. H. Graffis, Herbert Graffis and Jos. M. Graffis, all of 28 E. Jackson Blvd., Chicago, Ill.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are (if there are none, so state):

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustees or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any person, association or corporation has any interest, direct or indirect, in the said stock, bonds or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise to paid subscribers during the six months preceding the date above is ..... (This information is required from daily publications only.)

TELEPHONE ENGINEER,
W. H. Graffis, Bus. Mgr.

Sworn to and subscribed before me this 22d day of March, 1926.

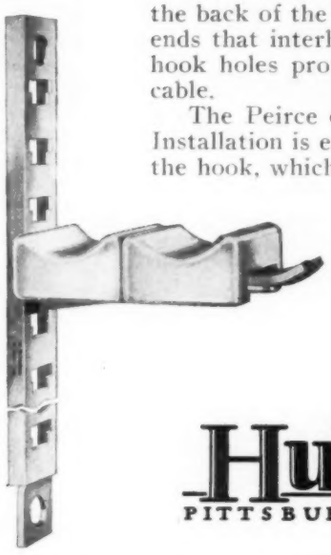
(Seal.) ETHEL E. MATSON.

(My commission expires Feb. 8, 1927.)

# These Peirce Specialties Better Your Underground Construction

For underground jobs of enduring satisfaction use Peirce Underground Cable Rack and Hooks with the Peirce Insulator for these hooks. The heel of the hook engages firmly in the back of the rack. The rack is made in three lengths with ends that interlock to make any desired overall length. The hook holes provide adjustment to accommodate any size of cable.

The Peirce cable insulators stay tight on the cable hook. Installation is easy, for you slide the insulator over the end of the hook, which is curved to prevent the insulator from coming off. With the Peirce insulator on the job cable creepage is permitted without injury to the sheath and insulation between the cable and rack is provided.



Get complete details of these Peirce essentials of good underground construction, and consult our catalog for hundreds of other items in line hardware and distribution equipment.

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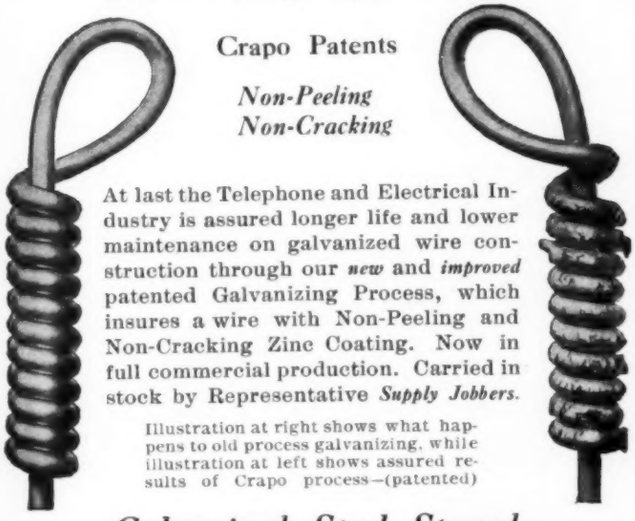

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*Non-Peeling*
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At last the Telephone and Electrical Industry is assured longer life and lower maintenance on galvanized wire construction through our *new* and *improved* patented Galvanizing Process, which insures a wire with Non-Peeling and Non-Cracking Zinc Coating. Now in full commercial production. Carried in stock by Representative *Supply Jobbers.*

Illustration at right shows what happens to old process galvanizing, while illustration at left shows assured results of Crapo process—(patented)

## *Galvanized Steel Strand*

Standard or Commercial, Siemens-Martin, High Strength and Extra High Strength Grades

***Indiana Steel & Wire Co., Muncie, Ind.***

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***A Marvelous New Molding Compound***

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# LINE AND DESK

## MAKING THE FORD TRUCK HANDY

Some time ago we remember seeing some comment in TELEPHONE ENGINEER on the subject of arrangement of trucks. Most of our work is light construction and we have a Ford truck which we have arranged for the job. I am sending a snap shot which is small but which may show how the truck looks. This picture was taken while the truck was on the job and she is not "dressed up to get her picture took." The box on the running board and a shorter one on the right running board are partitioned off to hold tools, bolts, lag screws, brackets, insulators, batteries, etc. The bed is an ordinary wooden body and the fixtures have been added to hold the ropes and blocks in front and as a support for the ladder and for the reels in the rear. The ragged coil of wire hanging on behind is some old junk iron wire that was taken down and is on its way to the junk pile. We have found this outfit to be very handy and while it may not look as nice as some more expensive outfits it does the work much better than a plain body on the rear of a Ford.—Contributed.

*This Ford outfit makes handy job.*

## SOME UNECONOMIC PRACTICES IN POLE UTILIZATION

Engineers and economists are realizing more and more the value of treated poles, but certain uneconomic practices are still effective. One of these is the use of small untreated poles over a short period of years because of necessity of replacement later due to heavier requirements. It has been considered cheaper to abandon the old lines, providing new poles for the new requirement. In the spirit of conservation it would be economic to pull up these small poles and set them somewhere else. This, of course, would not be possible if the original poles were untreated.

Of course, from the dollar-and-cents urge or pocket-book rule, the use of treated poles means a higher initial cost; but this is really economy, and the engineer with vision can convince the financial executive that treated poles defer the time for replacement, that the cost per pole per year takes a big drop and financial problems become less troublesome by at least one big item. To save a little initial expense by using untreated poles is to throw poles away. In other words, the use of treated poles is like spending an extra dollar now to save two dollars later.—W. F. Bancker in "Western Electric News."

## "BUGS WE HAVE SHOT"

Man doing a concealed job in new residence in city where floors had been laid of special material. Installer started to go into partition from cellar. Owner happened to enter front hall, heard a grinding noise and while he was speculating as to reason, a ¾-inch bit came up through the floor two feet from the wall. Another installer finished the job. —Contributed.

## "I'M HELPING HIM"

In a recent number of "Southern Telephone News" was story of appreciation of George Landry who for 35 years has been giving his best to the telephone service in New Orleans, and is now assistant to the district plant chief. It seems that Mr. Landry is quite a story teller and the following is quoted as one of his stock:

"One day a cableman was sitting on the edge of the sidewalk with his feet resting in the street. His helper was also warming the sidewalk on the other side. One of the supervisory force came up and being nearer the helper than the cableman asked him what he was doing. He looked up and pointing across the street to the cableman, in all seriousness replied: "I'm helping him."

## TEST YOUR AUTO BRAKES

The following comment from a seasoned member of its construction force which appeared in the company magazine of the Southwestern Bell Telephone Co. is worth quoting:

"We should never drive a car with poor brakes. I have driven a car continually for fourteen years and never hit anyone. I will not drive a car with poor brakes.

"When you leave Union Station on a train, you will notice after the train has pulled out about one hundred feet the brakes will be applied. This is done in every case. It is the engineer's test of the brakes on his train. He does not rely on the routine of repairs, he tests. If this simple test is made every day on our machines, accidents due to poor brakes will be reduced."

## A RURAL LINE TRANSPOSITION LAY-OUT

An Indiana telephone company asks for a layout of transpositions for a group of three rural lines which are to be made metallic on account of construction of a 5000-volt power line.

In the accompanying figure we have redrawn the sketch submitted and have marked the transpositions on the portion of the line exposed to the power circuit and, also, for the portion carrying three circuits. Since there are no phantom circuits on the lines and since the exposures to the power line are not severe (road separation and a balanced power

# Millions of Dollars are needlessly Wasted each year by the Rusting Away of galvanized materials.

TELEPHONE WIRE—GUY WIRE—MESSENGER WIRE — CABLE RINGS — GROUND RODS — ANCHOR RODS—NAILS—STAPLES—ETC., when made of galvanized steel or iron, contribute to this loss.

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It Does Not Rust Away

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The use of Copperweld does away with regular maintenance and replacement costs.

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IN CANADA——NORTHERN ELECTRIC CO., LTD.

*There is no other "copper-covered steel" or "copper-clad steel" made like "COPPERWELD"—by the Molten Welding Process.*

# BRAND—To Prevent Confusion and Loss

Brand your poles and cross arms while they are still in the yard. Branding prevents confusion and dispute over ownership when poles and cross arms are delivered and ready to raise. Branding makes your ownership sure.

Branding with name and consecutive numbers makes trouble-shooting easy. By giving linemen and trouble-shooters the numbers of the poles between which they are to work, they know exactly where to go.

Brand your tools also. Unmarked tools have a tendency to wander away mysteriously or to become lost. Branding prevents loss from carelessness of employees or from thievery.

Everhot Branding Torches make branding a quick and simple operation. Everhot brands continuously. Burns ordinary gasoline which is carried right in the handle. You can carry the Everhot Outfit anywhere and use it anywhere. Used with soldering attachments for soldering joints. Soldering iron stays hot and is used continuously.

*Write or wire for prices and complete data*

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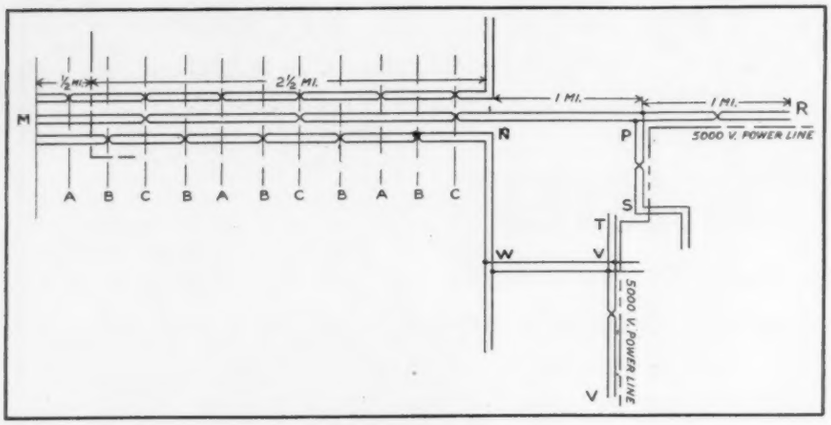
circuit being assumed), the ordinary ABC scheme is the simplest and best to use. Transpositions should be spaced every quarter mile and the distances should be obtained by measurement rather than by counting poles. In the sections where only a single metallic circuit is carried without power line exposure, the line may be transposed about once a mile. In the power line parallels, such as in the sections marked PR PS and TV, the transpositions should be located as nearly the exact center of the section as can be determined. The layout, as shown, should give lines that are reasonably free from crosstalk and inductive noise, if the lines are clear and free from grounds and high resistance joints.—**Staff contribution.**




*Rural line transposition.*

## OHIO HAS BIGGEST MEET

Columbus, Ohio—Ohio telephone men and women gathered here on Wednesday, Thursday and Friday, April 21, 22 and 23 in one of the largest state conventions ever held. The total registration was 753 and over 450 were seated at the annual banquet on Thursday evening. Exhibitors were present in force and every available space in the commodious exhibit hall was occupied.

The sessions opened at 2:00 p. m., Wednesday, with the annual report of President Frank A. Knapp. President Knapp pointed out the existence of two groups of men in the Independent telephone field, those who want to stay in the business and those who do not. The latter group is not large but the sooner it is eliminated the better it will be for the industry. It is a decided advantage to have a neighboring company which is progressive and enthusiastic. A way should be found to permit such companies to absorb their stolid, unprogressive neighbors. One of the developments of the year has been the activity of groups of brokers who are seeking to purchase Independent telephone properties, but little seems to have come from their efforts. The fact remains that the best market for telephone property lies within the industry itself.

Secretary Frank L. McKinney then presented his report which showed an increase in membership in the past year from 190 to 225 and told of the work of the association in legislative matters.

The things which are involved in an extensive program of reconstruction and rehabilitation were told next by John Collins, general manager of the Logan Home Telephone Co.

Dr. C. L. Jones of Athens then presented in his characteristic way his thoughts on "The Compensation Due Efficient Telephone Executives."

Another straight from the shoulder talk was given by George B. Quatman, general manager of the Sidney Home Tel. Co. on the topic "The Wonderful Age in Which We Live."

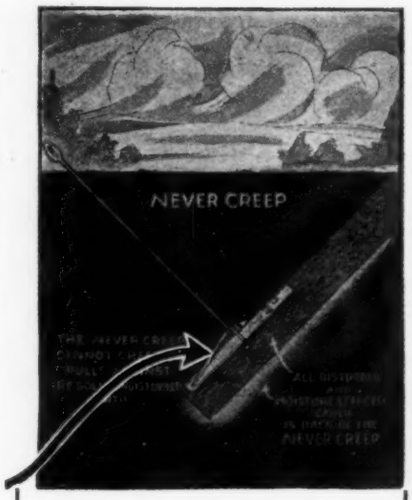
The final paper of the morning program by a discussion of telephone accounting by C. B. Russell of Marion.

The last general session of the convention was held Friday morning and was opened by a few remarks by the newly elected president of the association, Dr. C. L. Jones. This was followed by an interesting and entertaining illustrated lecture on "Your Directory; an Important Supplemental Service," by Perry Ballou of the L. M. Berry & Co. organization.

C. W. Henry, secretary of the Knapp telephone properties, then discussed "Selling Wired Broadcasting to Telephone Subscribers," indicating the methods employed and explaining the possibilities.

"Co-relating the Work of the Commercial, Plant and Traffic Departments" was the next paper which was presented by H. E. Simonton of the Lima Tel. and Tel. Co.

Gustav Hirsch, consulting engineer of Columbus, then gave the final paper of the convention on "Reorganizations and Rate Cases."




In *Any* Soil

**Never-Creep Anchors**

**have Superior Holding Power**

In sandy, moist, adobe, or any other soils, the great holding surface of the NEVER-CREEP and its pull against solid, undisturbed earth gives an anchorage that is unsurpassed.

The more you look into anchor construction and performance the more you realize that undisturbed earth to pull against is a vital consideration. Tamping very seldom suffices to give the holding condition an anchor needs. Moisture seeps down to the holding plate of the anchor and collects there with a great sacrifice of the anchor's rigidity. You know how these factors ruin holding power, so play safe by standardizing the NEVER-CREEP and get away from the perils that are bound to come when the earth is disturbed during anchor installation.

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Foremost wire companies prefer the NEVER-CREEP. So will you when you learn its complete story. Write us for details.

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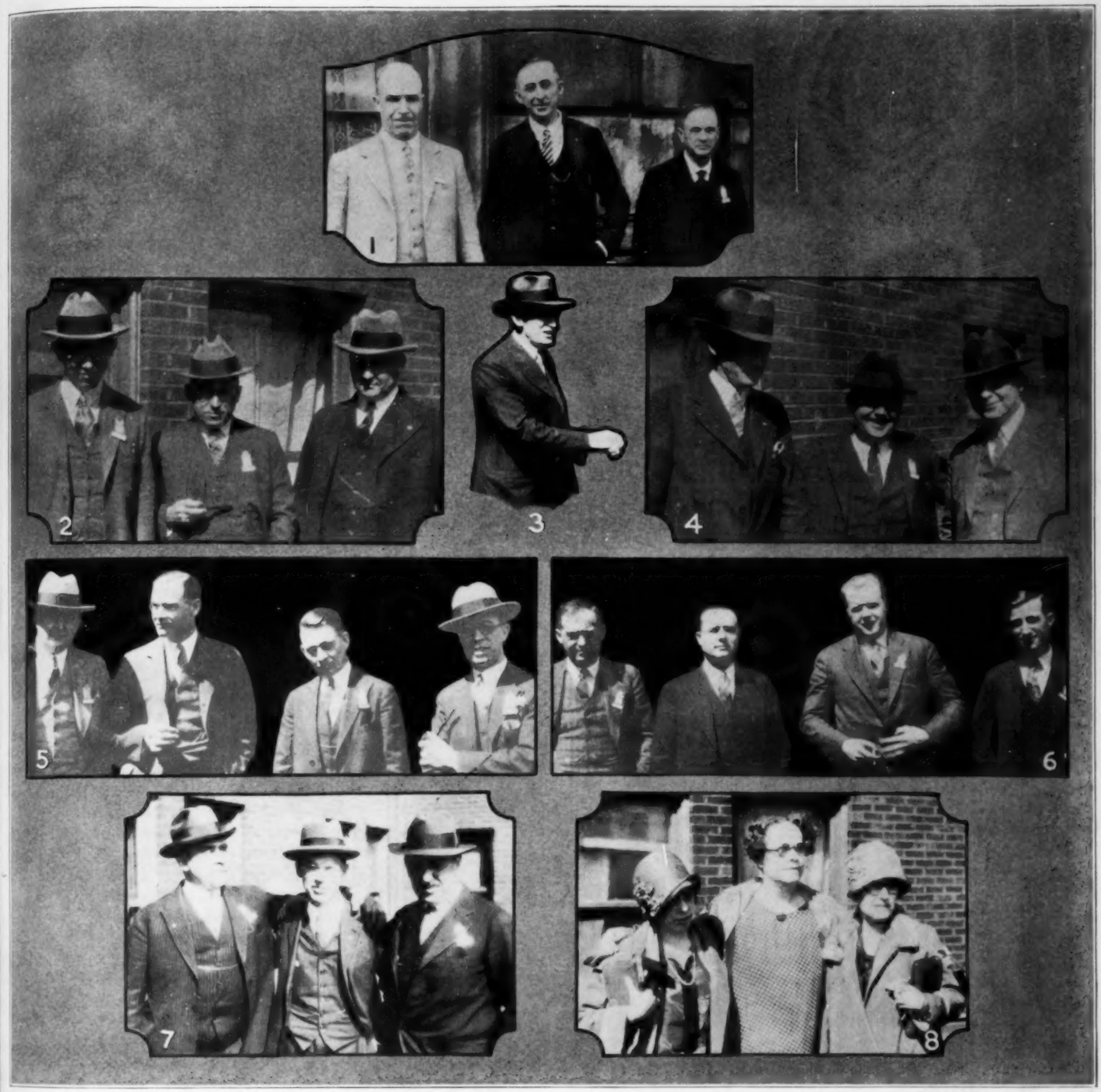

*1.—A Hawkeye Triumvirate; Charley Deering, sec.-treas., F. G. Moore, pres. elect and M. A. Reed, past president. 2.—J. R. Denkhoff, sec.-treas., Interstate Telo. Co.; G. B. Foscue, Jr., securities dept.; Theodore Gary & Co.; J. H. Denkhoff, pres., Interstate Telo. Co. 3.—Jack Coffey all by hizzelf. 4.—Coffey, R. L. Parker, manager at Traer and other Iowa points; Hi Currier. 5.—Frank Eldridge, French's Battery campaigner; Bill Jackson of Lynton T. Block & Co.; Al Johnson, busy young boss of the A. J. Johnson Co., telephone material and supply jobbers, and Earl Shields of Cook Electric Co. 6.—Monarch's "Four o'Clock George" Wilson, the boss; L. Q. Trumbull, Roy W. Siemund, mgr. supply sales, and R. G. Faulhaber, sales mgr. 7.—Howard Leinard, dean of the Bell diplomatic corps; Frank M. Boardman, sec.-mgr., Story County, Ind., Telo. Co., and George Rodormer, Reliable Electric Co. 8.—Grace Coan, Anne Barnes and Mary Hill, three of the stars of the operators' conference.*

# *Moore Made Chief of Iowa Tribe— Expand Directorate at Meeting*

Des Moines, Iowa—F. G. Moore of Washington was elected president of the Iowa Independent Telephone Association at the 31st annual convention of the thriving Hawkeye organization. The meeting was one of the sprightliest the state has witnessed in years and was marked by an increase in the directorate bringing the number of directors up to 13, so that each part of the state will have representation.

Other officers elected were Charles R. Hurmence, Sumner, vice-president, and Charles C. Deering, Des Moines, secretary-treasurer. Directors for the coming year are: H. B. Melick, West Liberty; G. E. Atkinson, Creston; J. M. Plaister.

Fort Dodge; C. W. Quillen, Mount Pleasant; E. L. Farwell, Manchester; Philip Zerwas, Manning; T. A. Davenport, Belmond; J. E. T. Johnson, Gowrie; O. L. Loudenslager, Le Mars; F. M Lantz, Clarinda; W. L. Agee, Marengo; J. C. Newland, Sutherland; R. L. Parker, Traer.

Charley Deering has been giving the members their money's worth and then some, from the secretary's office of the association. That point stuck out plainly as the matter of fact recital of the last year's performance was made. In the presidential address of M. A. Reed there was stressed the importance of the smaller companies financing locally rather than attempt imitation of the financing procedure of the larger enterprises. Mr. Reed told of the part the Independents played in promoting the extension of the telephone industry during its first fifty years.

Further attention to the financial problems was given in the remarks of W. D. Hanna of the Hanna-Shreves Co., Burlington. Mr. Hanna spoke from a close-lowing data should be given the investment banker:

Gross revenues from operations.

Expenses of operation, including taxes, maintenance and depreciation.

Net operating revenue.

Interest charges, dividends and additions to surplus.

This statement must be compared to previous years and also with statements for similar companies.

Much comment and discussion followed the Hanna address. J. G. Crane, vice-president of the Gary organization, in reply to a query, told that the Gary plan of issuing securities for an operating company called for one-third in common stock, one-third in preferred and one-third in bonds.

President MacKinnon of the U. S. Independent Telephone Association reiterated the policy of the Independent association with respect to the Bell and cited the Pennsylvania situation as an example of a fair trade of territory between the Bell and Independents. The Independents' plan for preserving and strengthening their part of the industry was told to the Hawkeyes in a staunch and straightforward manner by the Independent chief, who has made this statement one of the features of the state conventions recently held.

Work of the Iowa Railway Commission in keeping the wire using companies of the state happy was detailed by George M. Charlesworth, electrical engineer of the commission. Mr. Charlesworth said the high-tension line saturation point in Iowa had nearly been reached so less new trouble from this source might be expected by telephone companies.

W. H. Fowler spoke in a reminiscent vein on the fiftieth anniversary of the telephone. He paid tribute to a number of the Iowa pioneers. The personal side of the convention held further sway when some of the distinguished visitors were introduced.

Public liability and property damage insurance was explained to the convention by W. D. Jackson of Lynton T. Block & Co. Jackson's company handles a big volume of telephone company business and this gave him a background for making a very vivid presentation of the insurable responsibilities with which a telephone company is burdened.

The Iowa association plans to take some action on the vocational training plan presented by Prof. J. V. Lynn of the Iowa State College, who spoke on "The Value of the Organized Training Program" and cited the case of the Northwestern Bell school for operators. F. G. Moore presided over the lively general forum which concluded the convention. This forum covered a wide range of territory and gave practical subjects handling by experts.

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Diagonal Cutting Pliers. No. 2601, 6 in. $1.65
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EVERY pair of Kraeuter Pliers is hardened with extreme accuracy.

Their cutters are *hard* but not brittle.

Their rugged lap-joints *fit close*, and hold the cutters true.

Every pair is tested at the factory for *strength, toughness* and *cutting power*.

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## E. S. Sterrett Dies in Florida After Long Illness

St. Petersburg, Fla.—Edwin S. Sterrett, one of the most prominent and popular Independent telephone men in Illinois, died here April 10, age 57. For the last five years Mr. Sterrett has been in poor health, having suffered a paralytic stroke, which, despite its severity, did not prevent his attendance at the annual Illinois conventions where he always was a welcome and active factor.

At the time of his death Mr. Sterrett was general manager and purchasing agent of the Cheadle-Sterrett properties. For ten years he has been associated with C. B. Cheadle in the management of fifteen flourishing telephone properties. He conducted his end of the business since 1918 from his office at Henry, Ill., and found time to contribute to the general good of the cause by serving as a vice-president and director of the Illinois Telephone Association for a number of terms. He dated his advent into the telephone business back to 1898 when he, with C. A. Camp, formed the Henry Telephone Co. From 1904 to 1910 he was in the real estate business, leaving that activity in 1910 to form a partnership with C. B. Cheadle.

Mr. Sterrett was of a temperament that endeared him to all those he met. As a straight-shooting, able, and courageous business man his eulogy has been sounded by hundreds who lament his passing.

### CLASS "A" CONFERS

Chicago, Ill.—Annual conference of the Class A member companies of the Independent national association was headlined by release of a good general summary of the financial conditions of these companies, progress toward uniform accounting methods and proposal of a loose-leaf plant handbook.

President MacKinnon proposed the printing of Class A group and individual company statistics for distribution among financial houses. The proposed accounting handbook was discussed. Income tax and I.C.C. cases came in for exhaustive deliberations.

G. W. Robinson, president of the Tri-State, led an interesting discussion on the subject of uniformity in annual reports submitted to stockholders.

Among the officials who spoke in expert capacities were A. L. Staderman, R. B. Still, R. V. Achatz, and Chairman Cragg of the accounting division.

The general comparative summary of the 38 Class A member companies of the Independent association for 1916, 1923, 1924 and 1925 is given below.

Martinsdale, Mont.—Alfred Van Camp is chairman of a committee named to plan a telephone company here.

## H. N. Collins, Kellogg Man, Dies Suddenly

Grand Rapids, Mich.—Herbert N. Collins, recently made Michigan representative for the Kellogg Switchboard and Supply Co., died at Boston, Mass., April 29. Mr. Collins had gone to Boston for examination and treatment, having been in poor health for several weeks.

*H. N. Collins*

Prior to his Kellogg connection Mr. Collins was with the Citizens' Telephone Co. of Grand Rapids for 26 years.

## Rolfe Again Made President by Californians at Annual Meeting

Officers elected at the annual California convention:

President—Charles A. Rolfe.
1st Vice Pres.—Carl H. Lorbeer.
2nd Vice Pres.—A. Terkel.
Treasurer—F. R. Ferguson.
Directors—C. H. Button, Jas. S. Campbell (of Corona), C. F. Mason, F. H. Wright, A. Wardman.

Los Angeles, Cal.—California Independent Telephone Association at its annual meeting had a good attendance and a fine representation of the different parts of the state, although the date seemed to be considered as an unfavorable one for some. The Board of Directors held a meeting before the general meeting, and considered several matters which were later referred to the assembly for its consideration.

President Rolfe opened the annual meeting by handing his report for the year to the Secretary, who read it to the meeting. Mr. Rolfe supplemented the statements in the report with a few remarks.

The president touched upon the desirability of having some means by which telephone securities may be made legal investment for savings banks, without long and expensive investigation after they have been approved by the Railroad Commission. He also talked about making provisions for the continuity of management as a stabilizing force in valuation of securities

The report of the Treasurer was then received and a vote of thanks extended to Treasurer P. R. Ferguson for his work during the last year. This was followed by the reading of the report of the Secretary. This report dealt more with the details of Association work, including the establishment of an office, appearances before the Commission, the appointment of special committees for the consideration of technical problems, the pole-contact agreement, and related matters. A vote of thanks was extended to Mr. Irwin for his work during the year, also.

W. J. Dodge of the California Railroad Commission was called upon and made an inspiring talk

## Telechronometer Service on Time Basis at Everett, Wash.

Everett, Wash.—Restoration of the telechronometers in the Everett district of the Puget Sound Telephone Co., ordered by the state department of public works, will start a second stage of the experiment with telephone service to be paid for in units of time measurement. The experiment was begun in Everett April 1, 1923, and discontinued after a short time. The recent order of the state department was handed down three years later, almost to the day.

Rates now authorized by the state board shows considerable downward revision from the rates originally applied, the ready-to-serve or installation charges ranging from $3 a month for one-party lines to 50 cents for 10-party lines. The sliding scale of rates for actual conversation runs from 9 mills down to 3 mills per telechrone, which means one minute of talk over the line. These rates also are lower than the rates asked for by the telephone company when it joined with more than 50 per cent of its patrons in asking the state department to restore the telechronometers.

Atchinson, Kan.—Tough going is ahead for the squirrels. City has given telephone company permission, in defiance of an ordinance, to kill squirrels that gnaw telephone cable.

Holstein, Ia.—Holstein, Advance Rural and Cushing telephone companies have been consolidated.

West Chester, Ia.—Plant of the Washington Mutual Telephone exchange recently was destroyed by fire.

Afton, Ia.—D. C. Phillips and Paul H. Lyday, formerly of Marengo, have bought the local telephone plant.

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Knickerbocker
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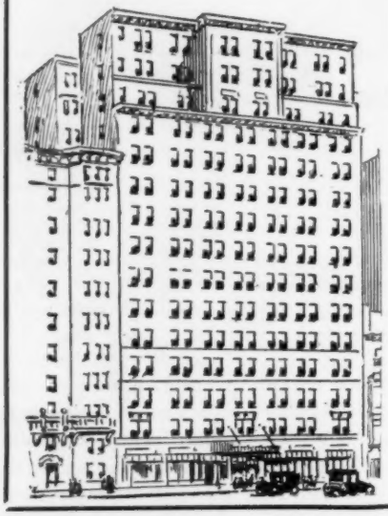
*Just East of Broadway, Times Square*

New York's Newest Hotel

A location unsurpassed. A few seconds to all leading shops and theatres. Away from the noise and bustle and still convenient to everything. Between Grand Central and Pennsylvania Terminals.

RATES
$3 to $5 per Day
400 Rooms—400 Baths



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**Everstick Anchor Co.**
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***Speedy!***

**Just loop the wire on and drive. That's the way to install**

**EUREKA FIBRE INSULATED NAILS**

Superior for telephone, telegraph and bell wiring. Uniform, finished appearance. Do not injure woodwork. Furnished in gray or black fibre: polished brass, oxidized or special wire nails; a flexible rubber bushing giving a thick insulation.

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For Sale—Complete seven-position Western Electric Switchboard with equipment for about 600 lines. Common battery type. Modern, good condition, practically new. Only one position used for any length of time and that as private exchange. Write for copy of specifications. A bargain.

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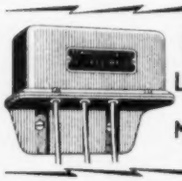

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**FOR SALE**

Telephone Exchange in Rome City, Ind. Property valued at $5,000. Will sell for less than half price. Address Rosalie Fox-Yergin, Rome City, Ind.


### Georgia Plans Big Meet at Atlanta, May 26-28

Atlanta, Ga.—Annual convention of the Georgia Independent Telephone Association will be held at the Henry Grady Hotel here, May 26, 27 and 28. The Georgia convention draws well from its own territory and that of adjoining southern states. Plans for this year's meeting promise an interesting practical program and a large attendance.


**Easy to See Why the UNIQUE FURNACE is preferred**

PATENTED ARRANGEMENT FOR DISLODGING COIL WITHOUT TEARING DOWN FURNACE
PATENTED SEAMLESS TUBING COIL GENERATOR
IMPROVED ONE PIECE BURNER
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"UNINTERRUPTED SERVICE"—the result of a "UNIQUE DESIGN and BETTER CONSTRUCTION."

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| Western Elec. No. 20 desk stand equipped with Kellogg Transmitters Stromberg Rec. and Rebuilt Special 4-bar 1000 or 1600 ohm signal set @ $12.00—5-bar @ | 12.50 |
| Stromberg No. 357 Straight line Common Battery Steel hotel sets @ | 5.75 |
| Kellogg No. 28 magneto desk sets with Rebuilt Spec. New signal sets 4-bar —1000 or 1600 ohm Bdg. @ $11.00—5-bar @ | 12.00 |
| Stromberg No. 428 or Dean magneto desk sets 3-bar 1000 or 1600 ohm Bdg. @ $8.50—4-bar @ $9.25—5-bar @ | 9.80 |
| Queen-Acme Portable Wheatstone Bridge @ | 35.00 |
| Stromberg No. 599—4-bar 1000 or 1600 ohm Bdg. compacts @ | 6.90 |
| Chicago Telephone Supply Co., 4-bar 1000 or 1600 ohm Bdg. compacts @ | 6.75 |
| Monarch 4-bar 1000 or 1600 ohm Bdg. compacts @ | 7.25 |
| American Elec. No. 36 type 5-bar 1600 ohm Bdg. compacts @ | 7.50 |
| Stromberg No. 992 type 3-bar 1000 or 1600 ohm Bdg. desk set @ $10.00—4-bar @ $10.50—5-bar @ | 11.00 |
| Kellogg Local or Common battery transmitters complete @ | 1.10 |
| Swedish Am. or Stromberg ½ M. F. Condensers @ | .35 |
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# Unit Position Sectional Type Switchboard

This is the ideal multiple type switchboard for growing exchanges. The cabinet is constructed of unit type single operator sections and so designed that when placed in position the entire switchboard has the appearance of a continuous cabinet. Additional sections may be added at any future time.

Each section has two equipment mounting panels, arranged for either magneto or common battery lines, lamp supervision and 15 universal cord circuits.

A Calculagraph section, as shown in this illustration may be furnished if desired. This section is one panel in width and so constructed that it will line up with the regular position sections. The key shelf is drilled and blanked for mounting the Calculagraph and the face of this panel may be used for an overhanging multiple.

It is the ideal switchboard for any exchange where two or more operators positions are required.

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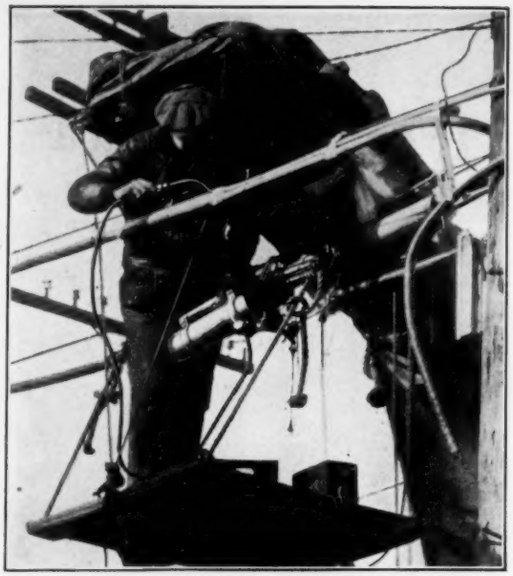

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It's easily portable anywhere. The heat is instant and intense. You merely turn on the gas and the Prest-O-Lite Torch gives you the flame you want.

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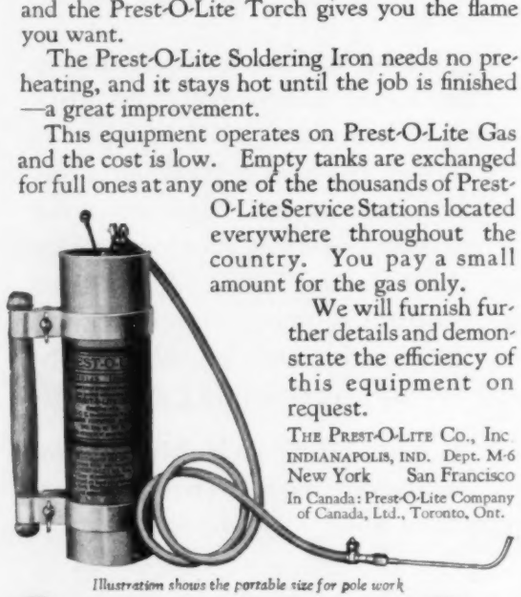

*Illustration shows the portable size for pole work*

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